Poster 2

April 30 (Tuesday) / 15:10 ~ 16:30 / Capri room

Components

P2-3.1 / Improvement Of Hybrid-Type High-Power Gyrotron Launcher

Wenqi Li (Chinese Academy of Sciences / University of Chinese Academy of Sciences, China), Zhiqiang Zhang (Chinese Academy of Sciences / University of Chinese Academy of Sciences, China), Jirun Luo (Chinese Academy of Sciences / University of Chinese Academy of Sciences, China), Yong Li (Chinese Academy of Sciences / University of Chinese Academy of Sciences, China), Yu Fan (Chinese Academy of Sciences / University of Chinese Academy of Sciences, China)

A numerical synthesis method for hybrid-type high-power gyrotron launchers has been tested to transform the $TE_{32,9}$ mode of the ITER EU 1-MW gyrotron operating at 170GHz with a specific set of TE modes to generate a Gaussian-like field distribution as the target function. However, we cannot perfectly transform the operating mode into the specific set of TE modes of target function due to the diffraction effect of the launcher cut. In this case, we proposed a method to generate an optimized target function to improve the process of transforming the operating mode into the target set of TE modes. Simulation results show that the higher fundamental Gaussian mode content(FGMC) of 99.1% of the RF wave beam can be achieved at the aperture of launcher using the optimized target function.

P2-3.2 / Study on Secondary Electron Multiplication Characteristics of 1.3GHz High Power Coupler Cold Window

Yao Long (Institute of Electronics / University of Chinese Academy of Sciences, China), Wang Yong (Institute of Electronics / University of Chinese Academy of Sciences, China), Zhang Rui (Institute of Electronics, China), Zhang Xue (Xiang tan University, China)

In this paper, the design of a 1.3GHz high power coupler cold window is presented for the Shanghai light source hard X-ray free electron laser system. The cold window consists of 3 parts: outer conductor, inner conductor and ceramic window. The multipactor effect is a resonant vacuum electron discharge that appears in components operating with high power electromagnetic field. When certain RF resonance condition is met, the secondary electrons grow exponentially, which leads to remarkable power losses and heating of the ceramic window, so that it becomes impossible to increase the fields by raising the incident power.

P2-3.3 / Study of Gaussian Mode Output Window for 140GHz Gyrotron

Zhiliang Li (Beijing Vacuum Electronics Research Institute, China), Bentian Liu (Beijing Vacuum Electronics Research Institute, China), Yang Zhang (Beijing Vacuum Electronics Research

Institute, China), Jinjun Feng (Beijing Vacuum Electronics Research Institute, China)

The paper describes study of a Gaussian mode output window for 140GHz gyrotron oscillator. According to the law of Fresnel, the output window is optimized and designed by using numerical calculations. Then, the design parameters are obtained. Finally, an output window was fabricated and tested. The testing results show that theoretical analysis are in good agreement with cold test, the output window can achieve bandwidth of 5GHz when VSWR below 1.3.

P2-3.4 / Study on a Novel Directional Coupler for Rapid Power Measurement of the W band Gyro-TWT

Xu Zeng (Beijing Vacuum Electronics Research Institute, China), Efeng Wang (Beijing Vacuum Electronics Research Institute, China), Jinjun Feng (Beijing Vacuum Electronics Research Institute, China)

A study of a novel directional coupler for measuring the output power of a W-band gyro-TWT has been presented. The designed directional coupler is a three ports device, in which, the multi-apertures with different diameters have been arranged in two rows. By using it, the rapid power measurement for the W-band TE01 mode gyro-TWT has been achieved. The measurement result indicates that the coupling coefficient of the directional coupler is between -50dB and -56dB with the bandwidth of 6GHz, which agrees well with the simulation result. In additional, the influence of the arrangement method of the apertures on the coupling coefficient has also been analyzed.

P2-3.5 / Optimization Design of Gyrotron Quasi-optical Mode Converter Launcher

Zhao Guohui (Chinese Academy / University of Chinese Academy of Sciences, China), Xue Qianzhong (Chinese Academy / University of Chinese Academy of Sciences, China), Wang Yong (Chinese Academy / University of Chinese Academy of Sciences, China), Wang Xuewei (Chinese Academy / University of Chinese Academy of Sciences, China), Zhang Shan (Chinese Academy / University of Chinese Academy of Sciences, China), Zhang Lianzheng (Chinese Academy, China)

An optimized design results of a launcher for 94GHz TE_{62} mode gyrotron quasi-optical mode converter are given in this paper. The launcher is designed by coupling mode theory and has two stages of perturbations. Under the condition that the original perturbation length remains unchanged, the perturbation amplitude is optimized and the variation of the perturbation amplitude along the axis is obtained. The simulation results show that the beam launched by the optimized launcher has no side lobe at the position of mirror 1 compared with that before optimization.

P2-3.6 / Design of Phase Correcting Mirror for Gyrotron Quasi-optical Mode Converter

Zhao Guohui (Chinese Academy / University of Chinese Academy of Sciences, China), Xue Qianzhong (Chinese Academy / University of Chinese Academy of Sciences, China), Wang Yong (Chinese Academy / University of Chinese Academy of Sciences, China), Wang Xuewei (Chinese

Academy / University of Chinese Academy of Sciences, China), Zhang Shan (Chinese Academy / University of Chinese Academy of Sciences, China), Zhang Lianzheng (Chinese Academy, China)

In this paper, the design of a phase correcting mirror is presented for the mirror system of 94 GHz TE_{62} mode gyrotron quasi-optical mode converter. The mirror system consists of 3 mirrors, the third mirror is phase correcting mirror. The phase correcting mirror designed based on Katsenelenbaum-Semenov Algorithm (KSA). After adding phase correcting mirror into the mirror system, the scalar and vector mode contents on the output window increased by 1.2794% and 2.5647% respectively.

P2-3.7 / Design of Water Cooling System for 170GHz, Long-Pulse Gyrotron

Yichi Zhang (Beijing Vacuum Electronics Research Institute, China), Bentian Liu (Beijing Vacuum Electronics Research Institute, China), Xu Zeng (Beijing Vacuum Electronics Research Institute, China), Yang Zhang (Beijing Vacuum Electronics Research Institute, China)

A water cooling system has been designed aiming to insure the 1MW 170GHz gyrotron stable operates under continuous wave (CW) operating condition. In this work, thermal loss power of main parts is calculated by theory analysis and software simulation. Considered to maximum allowable heat-flux, the water cooling system controls the maximum temperature below the boiling temperature and the deformations of the geometry are significantly small enough not to influence the performance heavily.

P2-3.8 / The Vacuum Window for 0.34-THz Folded Waveguide Traveling Wave Tube

Peng Hu (China Academy of Engineering Physics, China), Wenqiang Lei (China Academy of Engineering Physics, China), Yi Jiang (China Academy of Engineering Physics, China), Yinhu Huang (China Academy of Engineering Physics, China), Rui Song (China Academy of Engineering Physics, China), Hongbin Chen (China Academy of Engineering Physics, China)

The vacuum windows for a 0.34-THz folded waveguide traveling wave tube are designed and fabricated, the window structure is modified pill-box window structure and the window dielectric is sapphire piece. In the cold-test measurement, the bandwidth S_{11} parameter below -15 dB achieves 30 GHz.

P2-3.9 / Electromagnetic particle-in-cell simulations of dielectric multipactor

Wang Huihui (University of Electronic Science and Technology of China, China), Liu Laqun (University of Electronic Science and Technology of China, China), Liu Dagang (University of Electronic Science and Technology of China, China), Meng Lin (University of Electronic Science and Technology of China, China)

The multipactor of dielectric window is studied by electromagnetic Particle-In-Cell (PIC) simulations. Firstly, simulations show that the multipactor of dielectric window on the upstream side is more serious than that on the downstream side. Secondly, the multipactor of dielectric

window on the upstream side in microwaves of TEM mode is simulated in more details, and compared to our theoretical results. It is found that the multipactor is more serious than Kishek's model in the regions of weak dc electric fields and strong rf electric fields, which leads the vanish of upper boundary. Thirdly, the dielectric multipactor in microwaves of TE modes is simulated. It is found that the upper boundary reappears when the rf frequency of TE modes trends to the cutoff frequency of waveguide.

P2-3.10 / A Tri-band Serpentine Mode Converter Applied in High Power Microwave

Hao Li (University of Electronic Science and Technology of China, China), Keqiang Wang (University of Electronic Science and Technology of China, China), Chen Cai (University of Electronic Science and Technology of China, China), Yong Luo (University of Electronic Science and Technology of China, China), Tianming Li (University of Electronic Science and Technology of China, China), Jianing Zhao (University of Electronic Science and Technology of China, China), Chaoxiong He (University of Electronic Science and Technology of China, China), Xin Wang (University of Electronic Science and Technology of China, China)

In this paper, a tri-band serpentine mode converter applied in high power microwave is proposed. This mode converter consists of an outer coaxial waveguide and an inner embedding circular waveguide, and they have the same curvature distribution along longitudinal propagation axis. The outer coaxial mode converter operates at 8.5 GHz (X band) and 15 GHz (Ku band), the center frequency of the circular mode converter is 35 GHz (Ka band). In the mode converter, the injected coaxial TEM mode (coa.TEM) and circular TM_{01} modes (cir.TM_{01}) can be transformed simultaneously into coaxial and circular TE_{11} modes (coa.TE_{11} and cir.TE_{11}), respectively. The results validated by CST show that the maximum conversion efficiencies of the synthesized mode converter at central frequencies are all over 97.8%, and the bandwidths (conversion efficiency is over 95%) are 730 MHz, 820 MHz, and 720 MHz, respectively.

P2-3.11 / Simulation of A Ka-band Mode Converter from the Rectangular Waveguide TE_{10} Mode to the Circular Waveguide TE_{02} Mode

Wang Xiaoyan (Chinese Academy / University of Chinese Academy of Sciences, China), Gao Dongping (Chinese Academy, China), Wang Yong (Chinese Academy / University of Chinese Academy of Sciences, China), Yang Jie (Chinese Academy / University of Chinese Academy of Sciences, China), Zhang Fengzhen (Chinese Academy / University of Chinese Academy of Sciences, China), Zhang Lianzheng (Chinese Academy, China)

The structure of a mode conversion from the rectangular waveguide TE_{10} mode to the cylindrical waveguide TE_{02} mode is studied. The simulation results with Ansoft HFSS shows that the -3dB bandwith is about 2GHz and total efficiency is more than 70% from input rectangular TE_{10} mode to circular TE_{02} mode at Ka band. This mode converter made a foundation for a Gyro-amplifier operating in high-order mode.

P2-3.12 / Development of tuning diaphragm for high power continuous wave klystron

Yongqing Zhang (Chinese Academy of Sciences, China), Shengyi Yin (Chinese Academy of Sciences, China), Haibing Ding (Chinese Academy of Sciences, China), Xiangyang Gao (Chinese Academy of Sciences, China), He Jin (Chinese Academy of Sciences, China), Xiaoxin Sun (Chinese Academy of Sciences, China)

In order to meet the requirement of 150MHz frequency tuning range for continuous wave klystron, a copper/ Mn copper-nickel alloy/copper (Cu/ (Cu-Ni) /Cu) diffusion welding tuning diaphragm with a thickness of 0.3mm and the corresponding tuning mechanism were developed. During the research, the vacuum hot pressing diffusion welding of composite material, the stamping and forming of tuning diaphragm, the microstructure analysis of copper / Mn copper-nickel alloy /copper diffusion interface, and the test of turning range of tuning structure at X band are carried out. The results show that the tunable range of the composite diaphragm and the tuning structure can reach 280MHz, which is far beyond the design requirement.

P2-3.13 / Effect of Preparation Process on Surface Roughness of Parts for Welding Vacuum Envelope of Space Traveling Wave Tube

YUAN Guangjiang (Chinese Academy of Sciences, China), ZHANG Yuanmin (Chinese Academy of Sciences, China), LI Yunjin (Chinese Academy of Sciences, China), ZHAI Dehui (Chinese Academy of Sciences, China), SONG Wei (Chinese Academy of Sciences, China), WANG Xin (Chinese Academy of Sciences, China)

Surface roughness of parts is one of key parameters on bonding quality of transient liquid phase welding. In the paper, various preparation processes for parts of vacuum envelope of space traveling wave tube were employed. Differences among these preparation processes were studied. Parts of vacuum envelope were prepared by preferable processes. Perfect vacuum envelopes of space traveling wave tube were produced by transient liquid phase welding.

P2-3.14 / A Broadband low-lessW-band Pill-box Window

Tongbin Yang (University of Electronic Science and Technology of China, China), Wenjie Fu (University of Electronic Science and Technology of China, China), Xiaotong Guan (University of Electronic Science and Technology of China, China), Dun Lu (University of Electronic Science and Technology of China, China), Yang Yan (University of Electronic Science and Technology of China, China)

To develop wide-band low-loss window for W-band vacuum electronic devices, an asymmetric pill-box window is investigated in this paper. The presented pillow-box window is composed of standard waveguide, circular waveguide, and sapphire dielectric window. According to the equivalent circuit theory, initial parameters for the asymmetric pill-box window is designed. 3-D electromagnetic computer code CST is used to verify and optimize the design. By carefully controlling the errors in machining, assembly, and brazing process, a prototype sample is manufactured and test. The test results show that the S_{21} is > -1dB between the frequency

range of 76-110 GHz. The leak rate of the window system is 1.2E-10 Pa·m^3/sec.

P2-3.15 / A broadband three-way power divider based on E-Y structure

Zhe Wang (University of Electronic Science and Technology of China, China), Youlei Pu (University of Electronic Science and Technology of China, China), Wei Shao (University of Electronic Science and Technology of China, China), Xin Wang (University of Electronic Science and Technology of China, China), Yong Luo (University of Electronic Science and Technology of China, China)

In this paper, a broadband three-way power divider based on E-Y structure is presented. It can realize odd-ways power divider with compact structure, low loss, and low VSWR. In addition, the amplitude and phase are good balance. The simulated results of the power divider has shown that the return loss is greater than 30 dB, the amplitude difference of output ports is less than 0.1 dB from 26 to 40 GHz (the whole Ka-band).

P2-3.16 / A Broadband Ridge Gap Waveguide to Micro-strip Transition Using Probe Current Coupling

Songtao Peng (University of Electronic Science and Technology of China, China), Youlei Pu (University of Electronic Science and Technology of China, China), Wei Shao (University of Electronic Science and Technology of China, China), Xin Wang (University of Electronic Science and Technology of China, China), Yong Luo (University of Electronic Science and Technology of China, China)

Based on the current coupling theory, a broadband, low-loss micro-strip to ridge gap waveguide transition is presented in this paper. The impedance matching between ridge gap waveguide and 50 Ω micro-strip line is realized by the ridge probe. Compared with the traditional step impedance transformation, the probe transition can greatly expand the operating band and reduce the sensitivity to assembly tolerance. The optimized back-to-back ridge gap waveguide to micro-strip transition shows that the relative bandwidth of 100 % for S_{11} < -20 dB can be obtained. The insertion loss is better than 0.1 dB in the designed frequency bands for the whole structure.

P2-3.17 / A Novel TE_{01} Input Coupler for a W-band Gyrotron Traveling-Wave Tube

Chao Fang (University of Electronic Science and Technology of China, China), Guo Liu (University of Electronic Science and Technology of China, China), Wei Rao (University of Electronic Science and Technology of China, China), Yue Wang (University of Electronic Science and Technology of China), Shiyu Wang (University of Electronic Science and Technology of China, China), Jiangxun Wang (University of Electronic Science and Technology of China, China), Wei Jiang (University of Electronic Science and Technology of China, China), Li Wang (University of Electronic Science and Technology of China, China), Yong Luo (University of Electronic Science and Technology of China, China), Guoxiang Shu (Shenzhen University, China)

A novel input coupler, 4 coaxial sector waveguides excited via a rectangular TE_{10}, was simulated and verified by millimeter wave measurement. Simulations predicts that the average transmission was -2dB with a 3dB bandwidth of 15GHz (90-105GHz) and port reflection was less than -10dB. Excellent performance was observed, which was in good agreement with the simulation results. This input coupler has many available applications such as gyro-devices, high power transmission line, microwave and antenna system.

P2-3.18 / Coaxial Multipactor Susceptibility at GHz Frequencies

Nicholas M. Jordan (University of Michigan, USA), Flynn B. Darby (University of Michigan, USA), Stephen V. Langellotti (University of Michigan, USA), Y. Y. Lau (University of Michigan, USA), Ronald M. Gilgenbach (University of Michigan, USA)

Uncertainty in multipactor prediction currently leads to unanticipated device failures in many medium and high-power systems. Space-based systems, such as communication satellites, are strongly impacted by this uncertainty, due to their tight engineering requirements and susceptibility to signal degradation. The high-frequency coaxial regime, in particular, is not well characterized. We report here on experimental and computational results obtained in coaxial geometry for this frequency-space.

P2-3.19 / A Broadband Reflective Polarization Converter Based on the Metallic Grating

Yu Zhang (University of Electronic Science and Technology of China, China), Zewei Wu (University of Electronic Science and Technology of China, China), Wei Shao (University of Electronic Science and Technology of China, China), Xin Wang (University of Electronic Science and Technology of China, China), Hao Li (University of Electronic Science and Technology of China, China), Yong Luo (University of Electronic Science and Technology of China, China)

In this paper, a novel structure of reflective circular polarizer for millimeter wave band is proposed, which can convert the linear polarization to the circular polarization in a wide band. The proposed reflection-type circular polarizer is a metallic grating consisting of mushroom-shaped elements. The grating profile and period are optimized to provide great converting performance. The simulation results show that the 1.2 dB axial ratio bandwidth is about 5.6 GHz. The designed grating circular polarizer features simple structure and wide bandwidth, which can be used for broadband transmission systems in the millimeter wave range.

P2-3.20 / Compact Waveguide Coupler with Broadband and High Coupling Flatness

Miao Sun (University Of Electronic Science And Technology Of China, China), Yong Xu (University Of Electronic Science And Technology Of China, China), Tinghui Peng (University Of Electronic Science And Technology Of China, China), Ya Mao (University Of Electronic Science And Technology Of China, China), Weijie Wang (University Of Electronic Science And Technology Of China, China), Yong Luo (University Of Electronic Science And Technology Of China, China)

A compact rectangular waveguide coupler with high coupling flatness is proposed and measured in this paper. The coupler mainly consists of a main waveguide, a secondary waveguide and the coupling aperture array. Two rows and two columns of four square coupling holes combing two slots between each column holes is composed the coupling aperture array. It realizes broadband, high coupling flatness and compact size by adopting the proposed aperture array, especially for coupling flatness. For verification purpose, a Ka-band prototype has been designed, manufactured and measured. The total length of the coupler is only 56.7 mm and the experimental results by Vector network analyzer show that coupling degree varies −29.8 dB to −30.3 dB over the full waveguide bandwidth.

P2-3.21 / The dielectric constant measurement using a TE_{01} mode in W-band

Hong Eun Choi (Ulsan National Institute of Science and Technology, Korea), Wonjin Choi (Ulsan National Institute of Science and Technology, Korea), Mun Seok Choe (Ulsan National Institute of Science and Technology, Korea), Evgenya Simakov (Los Alamos National Laboratory, USA), Bruce Carlsten (Los Alamos National Laboratory, USA), Muhammed Zuboraj (Los Alamos National Laboratory, USA), Eun Mi Choi (Ulsan National Institute of Science and Technology, Korea)

The dielectric constant varies with frequency so that the known dielectric constant at low-frequency is no longer valid at high-frequency regions. When the frequency increases, experimental imperfection such as air gap between a sample and a resonator cannot be ignored anymore in the dielectric constant measurement by means of the resonator method. In contrast to the existing resonator method using a fundamental TE_{10} mode in a rectangular waveguide, we propose to use a TE_{01} mode in a circular waveguide which is less affected by the air gap between the surface of the waveguide and the dielectric material.

P2-3.22 / Electromagnetic and thermal analysis of high-order mode RF window

Xinde Sheng (Chinese Academy of Science / University of Chinese Academy of Sciences, China), Jirun Luo (Chinese Academy of Science / University of Chinese Academy of Sciences, China), Min Zhu (Chinese Academy of Science, China), Wei Guo (Chinese Academy of Science, China), Yu Fan (Chinese Academy of Science, China)

Electromagnetic and thermal analysis of high-order mode RF window was carried out using CST MPHY software, including transmission, reflection, insertion loss, and the temperature distribution on the disk of the window. A double-disk beryllia window, whose bandwidth of -25dB reflection was 2.16GHz and maximum temperature difference on the ceramic disk surface was 43K, was designed to applied to a 140GHz, $TE_{28,8}$ -mode operation gyrotron oscillator.

P2-3.23 / Design of a Q-band Circular Waveguide TE_{01} Mode Converter

Tinghui Peng (University of Electronic Science and Technology of China, China), Yong Xu (University of Electronic Science and Technology of China, China), Miao Sun (University of Electronic Science and Technology of China, China), Ya Mao (University of Electronic Science

and Technology of China, China), Weijie Wang (University of Electronic Science and Technology of China, China), Yong Luo (University of Electronic Science and Technology of China, China)

In this paper, a Q-band rectangular waveguide TE_{10} mode to circular waveguide TE_{01} mode converter is designed and analyzed. The topology of the proposed mode converter is constituted by an $TE^{\square}_{10}$ to $TE^{\square}_{20}$ mode converter with twist waveguide, $TE^{\square}_{20}$ to TE^{+}_{22} mode converter with cross-waveguide and the transformation from TE^{+}_{22} to TE°_{01} mode. The three segments of the proposed mode converter can be designed separately, and the linearly gradient structure is adopted in each segment for easy processing. Simulation results reveal that the insertion loss of the proposed TE_{01} mode converter is better than -0.06 dB and the return loss is below -20 dB at Q-band. It realizes high conversion efficiency (>98.6%) in a relative bandwidth of 36.6%.

P2-3.24 / 3D Printing Integrated Fabrication of CathodeHeater Assembly

Xin Sun (Beijing Vacuum Electronics Research Institute, China), Wensheng Shao (Beijing Vacuum Electronics Research Institute, China), Huaichao Yang (Advanced Technology & Materials Co. ,Ltd, China)

This paper reports on a new type of cathode-heater assembly and uses the selective laser melting (SLM) technology in 3D printing to achieve an integrated fabrication process. A thermal resistance of about 0.4 Ω.is reached after the excess heater sub-support columns are fused with a high energy laser. After applying a heating power of 21.6 W, the heater generated by the SLM reached a temperature of 1250 ˚C.

P2-3.25 / Design of the 94 GHz, TE_{62} Mode Generator Using Quasi-Optical Techniques

Shuang Chen (University of Electronic Science and Technology of China, China), Jinhao Li (University of Electronic Science and Technology of China, China), Yinghui Liu (University of Electronic Science and Technology of China, China), Jianwei Liu (University of Electronic Science and Technology of China, China), Xinjian Niu (University of Electronic Science and Technology of China, China), Hui Wang (University of Electronic Science and Technology of China, China), Guo Guo (University of Electronic Science and Technology of China, China), Lina Wang (University of Electronic Science and Technology of China, China), Tao Song (University of Electronic Science and Technology of China, China)

This paper details the core of the high-order TE_{62} mode generator components -- the coaxial resonant cavity. In order to obtain high purity TE_{62} mode and improve the isolation among the modes, we use a cavity with an improved coaxial structure. The slowly variable section open coaxial cavity structure can make the TE_{62} mode well separated from its nearby modes. In this paper, the influence of the inner and outer radii of the coaxial cavity on the resonant frequency is presented. The TE_{62} mode purity of the cavity was calculated by the MATLAB program to be 95.3% and the result of the HFSS simulation after the optimization design of the W-band high purity TE_{62} mode cavity is given, which is in close agreement with the ideal field distribution.

P2-3.26 / Progress of high power and long-pulse dual-frequency ECH system in KSTAR

Sunggug Kim (National Fusion Research Institute, Korea), Sonjong Wang (National Fusion Research Institute, Korea), Jongwon Han (National Fusion Research Institute, Korea), Mi Joung (National Fusion Research Institute, Korea), Jong-gu Kwak (National Fusion Research Institute, Korea)

ECH (Electron Cyclotron Heating) system for KSTAR (Korea Superconducting Tokamak Advanced Research) is composed of two dual-frequency gyrotrons, each generating 950kW of RF power at 140 GHz and 800kW of RF power at 105 GHz. EC system will be installed up to 6 gyrotrons. RF power generated by gyrotron is transmitted to antenna system. The distance of transmission line (TL) from output window of the gyrotron to the launcher is about 70m or more. TL system is composed of 63.5mm corrugated waveguides and several miter bends. The antenna for the EC system consists of two single ports and two dual ports. In this paper, we will describe the EC system currently installed in KSTAR and explain its future plans.

P2-3.27 / Interaction Impedance Measuring Method in Sine Waveguide

Qi Wu (University of Electronic Science and Technology of China, China), Jin Xu (University of Electronic Science and Technology of China, China), Shuanzhu Fang (University of Electronic Science and Technology of China, China), Pengcheng Yin (University of Electronic Science and Technology of China, China), Xuebing Jiang (University of Electronic Science and Technology of China, China), Xia Lei (University of Electronic Science and Technology of China, China), H.R.Yin (University of Electronic Science and Technology of China, China), L.N.Yue (University of Electronic Science and Technology of China, China), G.Q.Zhao (University of Electronic Science and Technology of China, China), W.X.Wang (University of Electronic Science and Technology of China, China), Yanyu Wei (University of Electronic Science and Technology of China, China)

The sine waveguide has been proved to be a promising structure with excellent transmission characteristics. In this work, a formula measuring the interaction impedance for sine waveguide is given based on the non-resonant perturbation theory. The measuring results of diversion characteristic and interaction impedance are compared with the simulation results for a sine waveguide slow-wave structure operating in W-band and the differences between the two results are less than 3.5% and 11.2%.

P2-3.28 / Evanescent Mode Resonance in Metasurface Antenna On Metal Surface

Jagannath Malik (Ulsan National Institute of Science and Technology, Korea), Sai Kiran Oruganti (Ulsan National Institute of Science and Technology, Korea), Woojin Park (Ulsan National Institute of Science and Technology, Korea), Bonyoung Lee (Ulsan National Institute of Science and Technology, Korea), Seoktae Seo (Ulsan National Institute of Science and Technology, Korea), Nak-Young Ko (Ulsan National Institute of Science and Technology, Korea), Dipra Paul Paul (Ulsan National Institute of Science and Technology, Korea), Hak-Sun Kim (Ulsan National Institute of Science and Technology, Korea), Franklin Bien (Ulsan National Institute of Science

and Technology, Korea)

We present a metasurface antenna comprising periodic arrangement of interconnected rectangular unit cells. The proposed antenna is designed to utilize evanescent mode resonance. The resonance is achieved by utilizing strong cavity mode oscillation, when the antenna is placed over a metallic surface. However, when the antenna is freely suspended in the air, in its natural state, the resonance is absent. At an optimized feed point, the antenna can be excited directly with a 50 ohm impedance line.

P2-3.29 / Thermal-Hydraulic Design and Analysis for High Power Dielectric Load Gyro-TWT

Wei Jiang (University of Electronic Science and Technology of China, China), Mengjun Wang (University of Electronic Science and Technology of China, China), Jianxun Wang (University of Electronic Science and Technology of China, China), Guo Liu (University of Electronic Science and Technology of China, China), Yaping Shen (University of Electronic Science and Technology of China, China), Guoxiang Shu (Shenzhen University, China)

The RF circuit is an important component in a gyro-travelling wave tube (Gyro-TWT) and its thermal performance influences the overall capability of the tube. Three different cooling structures for high power dielectric load Gyro-TWT are investigated. The simulation results are indicated that the capability is enhanced by employing the helical groove structure, and the coolant vaporization is suppressed. The Gyro-TWT based on helical groove is fabricated. The hot test for capability validation is on the way.

P2-3.30 / Effect of Thermal Deformation on Thermal Contact Resistance Between Helix and Support Rods in Helix TWT

Jinyan Wang (Southeast University, China), Jin Zhang (Southeast University, China), Xiaohan Sun (Southeast University, China)

In this paper, we analyze the effect of thermal deformation on the thermal contact resistance between the helix and support rods in the helix TWT. We simulate and discuss the stress distribution along the contact surface between the helix and the support rods with the helix deformation, and obtain the distribution of the thermal contact resistance along the slow-wave structure according to the relationship between the stress and the thermal contact resistance. The results provide a credible basis for establishing a more reasonable and accurate thermal analysis model for the helix TWT.

P2-3.31 / Design of High Power Vacuum Feedthrough for Multipactor Effect Suppression

Kwangho Jang (National Fusion Research Institute, Korea), Kenji Saito (National Institute for Fusion Science, Japan), Sonjong Wang (National Fusion Research Institute, Korea), Hyunho Wi (National Fusion Research Institute, Korea), Jonggu Kwak (National Fusion Research Institute, Korea)

A helicon current drive system need the high power vacuum feed-through (VFT) for the of upgraded KSTAR helicon current drive system. However, multipactor effect shows a problem of RF reflection in VFT vacuum region. So the proposed structure was to place a low electric field in the ceramic using a standing wave. The designed VFT shows the E_z value close to zero and the electric field absolute value of about 1.7kV/cm when transmitting 1MW in ceramic. It showed the high Q value of transmission characteristics at 476MHz.

P2-3.32 / Influence of Rectangular Aperture Aspect Ratio on Sheet Beam Generation

Nikita Gurjar (CSIR-Central Electronics Engineering Research Institute, India), M. Afaque Hossain (CSIR-Central Electronics Engineering Research Institute, India), R.K. Sharma ((CSIR-Central Electronics Engineering Research Institute, India), Niraj Kumar (CSIR-Central Electronics Engineering Research Institute, India)

A Pseudospark discharge based miniaturized sheet electron beam gun has been simulated using COMSOL Multiphysics software. The simulation has been performed to propose the dependency of the aspect ratio of rectangular aperture of hollow cathode on the onset of hollow cathode phase (HCP) as well as the HCP duration. Larger duration of the HCP is a desirable output as it increases the duration of energetic electron beam which leads to an effective beam-wave interaction. Therefore a comparative simulation study of varying aspect ratio with the change in HCP duration has been presented in the paper. A method has been proposed here showing the dependency of the aspect ratio of the rectangular aperture of sheet beam source on the HCP duration. The rectangular aperture aspect ratio has been varied from 5:1 to 12:1 for different applied gap voltage between 20kV to 25kV.

P2-3.33 / Time dependent output characteristics of horn antennas

Jinh-Shyang Yen (National Taipei University of Technology, Taiwan), Xuan-De Huang (National Taipei University, Taiwan), Chia-Wei Lin (National Taipei University, Taiwan), Kaviya Aranganadin (Hanyang University, Korea), Chii-Ruey Lin (Minghsin University of Science and Technology, Taiwan), Ming-Chieh Lin (Hanyang University, Korea), Hua-Yi Hsu (National Taipei University of Technology, Taiwan),

In this work, a three-dimensional conformal finite-difference time-domain simulation is employed to study the time dependent output properties of horn antennas for high power microwave (HPM) applications. As a benchmark, fundamental modes in standard rectangular and circular horn antennas are studied and compared with those simulated in frequency domain using HFSS. For steady state operation, the output characteristics shows similar behaviors in both frequency and time domainswhile in transient regime the time dependent characteristics demonstrates very interesting phenomena which might be better considered for a short pulse HPM operation. The final goal is to study the output characteristics of higher order modes for a specific application. Preliminary results obtained including near field and far field patterns and corresponding antenna parameters will be presented.

P2-3.34 / Estimating Internal Temperature of Slow Wave Structure Based on RBF Neural Network and Designing Test Model

Xingqun Zhao (Southeast University, China), Xiaoting Ying (Southeast University, China), Xiaohan Sun (Southeast University, China)

At present, there are many researches on the TWT (traveling wave tube) thermal properties. However, the investigations on the measurement of the temperature field inside the TWT are rarely involved. Based on RBF neural network model and ANSYS thermal simulation data of slow wave structure, a method for estimating the inner temperature of TWT is proposed in this paper, and the results with very small error are obtained by simulation data. At the end of this paper, a simplified model of slow wave structure is designed, which will be used to obtain real temperature data in the later stage to verify the reliability of the internal temperature estimation method.

P2-3.35 / Design and Experiment of Input Coupling Section for Coupled-Cavity Traveling Wave tube

Wei Guo (Chinese Academy of Sciences, China), Min Zhu (Chinese Academy of Sciences, China), Jirun Luo (Chinese Academy of Sciences, China)

In this paper, the design, experiment and improvement of an input coupling section for X-band coupled-cavity TWT are discussed. The idea, experiment and improvement are introduced. This input coupling section has been put into use. Considering the measured data, easy processing characteristics and experimental results, we think that the input coupling section achieves good results.

P2-3.36 / Study of a Promising Electrodynamic Photonic Crystal-like Structure inside a Rectangular Waveguide

Andrey Starodubov (Institute of Radio Engineering and Electronics RAS, Russia), Viktor Galushka (Saratov State University, Russia), Semen Kurkin (University of Saratov, Russia), Artem Badarin (University of Saratov, Russia/ Yuri Gagarin State Technical University of Saratov, Russia), Anton Pavlov (Saratov State University, Russia), Yurii Kalinin (Saratov State University, Russia), Alexey Koronovskii (Saratov State University, Russia)

Here we report on experimental and numerical investigations of an electrodynamic structure assembled according to photonic crystals' principles placed inside a X-band rectangular waveguide which is promising for microwave electronics. The features of dispersion characteristics of photonic crystals can be used for efficient excitation of high-order (and, hence, high-frequency) electromagnetic modes. In this work, the electrodynamic structure is a2D array of thin metal pins. Transmission and reflection of proposed system were measured experimentally and evaluated numerically. The experimental results are in good agreement with the numerical ones.

P2-3.37 / Design and simulation of L-band microwave waveguide circulator with increased efficiency and broad bandwidth

Kaviya Aranganadin (Hanyang University, Korea), Hua-Yi Hsu (National Taipei University of Technology, Taiwan), Ming-Chieh Lin (Hanyang University, Korea)

The industrial L-band WR975 circulators operating at a frequency range from 900 to 930 MHz have been designed and simulated. Commercially, an L-band circulator at 896 ± 10 MHz is available. However, for a wider bandwidth (~ 30 MHz) application, we would need two units operated in dual frequencies between 896 MHz and 915 MHz to cover the frequency range required. Through a Finite Element Method (FEM) simulation study, it was found that by reducing the height of the waveguide circulator in half a broader bandwidth can be obtained and this also leads to a reduction of overall fabrication cost. This paper discusses a detailed design and modeling of the L-broadband circulator operating at 915 MHz with a bandwidth of 43.5 MHz (892MZ to 935.5 MHz), an insertion loss of 0.25 dB for the entire bandwidth, and 0.22 dB at frequency of 915 MHz. For the entire bandwidth, the transmission efficiency is over 94.3% and it is more than 95% from 900 to 930 MHz of operating region which reduces power reflections for improving the performance and reliability of magnetrons. In addition, different ferrite materials are studied for optimizing this L-band waveguide circulator.