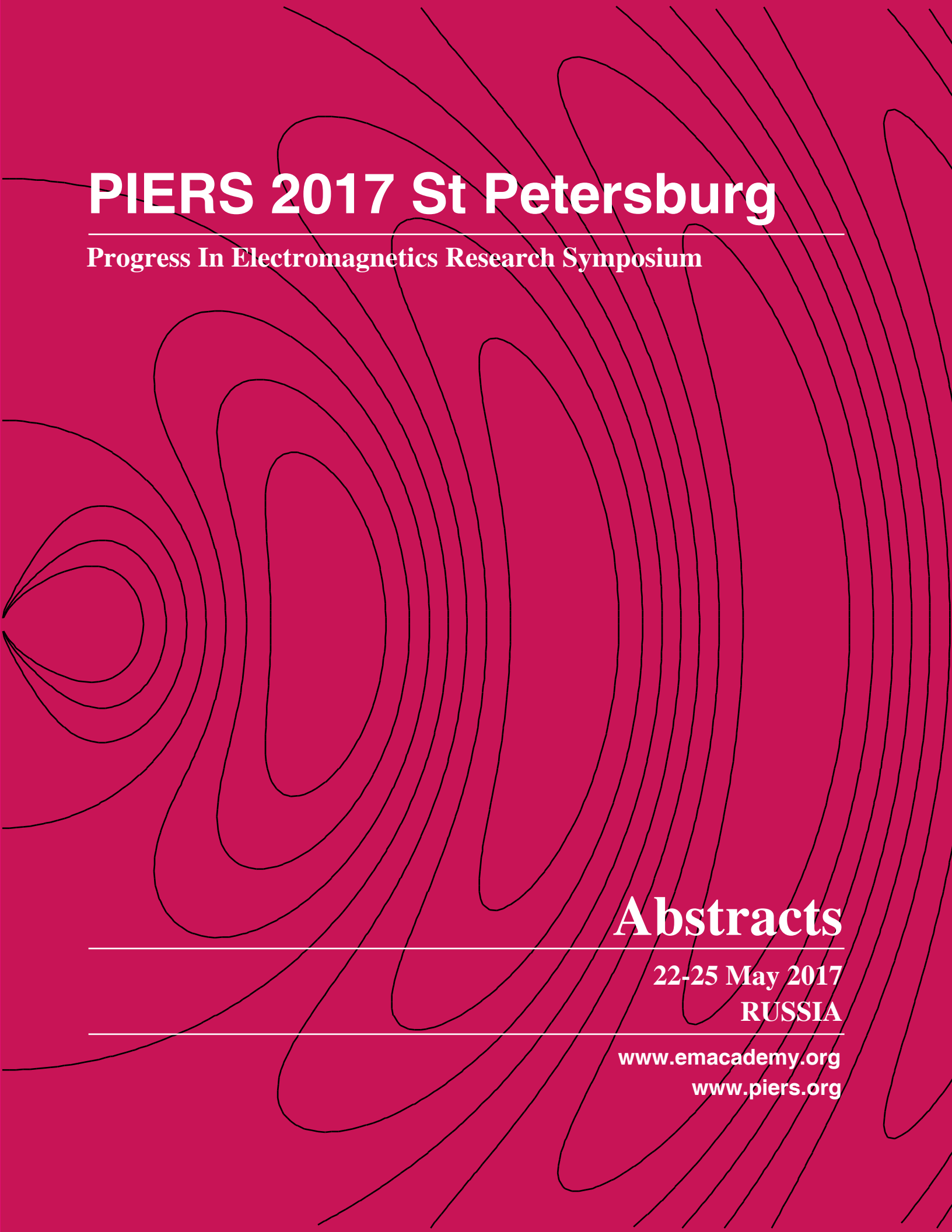
PIERS 2017 St Petersburg

Progress In Electromagnetics Research Symposium



Abstracts

22-25 May 2017
RUSSIA

www.emacademy.org
www.piers.org

Session 4P7
Microwave and Millimeter Wave Circuits and Devices, CAD 2

X-band GaN Power Amplifier Using Interposer-based MMIC

Junhyung Jeong, Jageon Koo, and Yongchae Jeong
Division of Electronics and Information Engineering, IT Convergence Research Center
Chonbuk National University, Republic of Korea

Abstract— Nowadays high power amplifier (PA) is an important element in RF wireless communications and radar systems. In order to achieve high power, high efficiency, and miniaturization, monotonic microwave integrated circuit (MMIC) designs with various dielectric materials and GaN transistors (TRs) are mainly performed. GaN process has high output power characteristic by high breakdown voltage, but it is mainly used TR die only because of high process cost. The MMIC technique is mainly used for the input/output matching circuits. A design method using a GaAs/Si substrate integrated passive devices (IPD) and a technique using high dielectric constant composite substrate are mainly used [1, 2]. However, these methods must use bonding wires to connect the GaN TR and the input/output matching circuits. The bonding wires degrade PA performances in the X band and difficult to stack the devices.

Figure 1 shows the proposed silicon interposer-based MMIC structure. Input and output matching circuits have the advantages of design freedom and reduce production cost by using standard silicon IPD process. The copper plate of the bottom is used for the grounding and heat dissipation characteristics of the GaN TR. In addition, the disadvantages of the bonding wire can be overcome because the GaN TR is embedded in a silicon interposer wafer.

To demonstrate the usefulness of the proposed interposer-based MMIC, a 70 W PA was simulated using CGHV1J070D of Cree Inc.. At 10 GHz, the output power and drain efficiency of simulated PA are obtained 49.5 dBm and 51.2% at the saturation point, respectively.

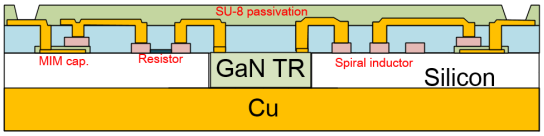


Figure 1: Fabrication layer of PAs using interposer-based MMIC.

ACKNOWLEDGMENT

Research reported in this work has been supported by ICMTC (Institute of Civil-Military Technology Cooperation) of Korea under an ICMTC program (16-CM-SS-16).

REFERENCES

1. Maehara, H., H. Uchida, N. Kosaka, E. Kuwata, K. Yamanaka, J. Nishihara, K. Kawashima, and M. Nakayama, "Internally matched GaN FET at C-band with 220 W output power and 56% power added efficiency," *Proc. Asia-Pacific Microwave Conference*, 2012.
2. Camiade, M., D. Bouw, G. Mouginot, F. Auvray, P. F. Alleaume, D. Floriot, L. Favede, J. Toorpe, and H. Stieglauer, "Highly integrated S and C-band internally-matched quasi-MMIC power GaN devices," *Proc. Eur. Microw. Conf.*, 1023–1026, 2012.