※課題番号　　　　　　　　　　　：F-12-IT-0028
※支援課題名（日本語）　　　　　： W-band MMIC の為の $In_xGa_{1-x}As$ メタモルフィック HEMTs
※Program　Title（in English）　　：Study of $In_xGa_{1-x}As$ Metamorphic HEMTs for W-band MMIC Applications
※利用者名（日本語）　　　　　　：張翼
※Username（in English）　　　　：Edward Yi Chang
※所属名（日本語）　　　　　　　：国立交通大学　材料工学科，台湾
※Affliation（in English）　　　　：Department of Materials Science and Engineering, National Chiao Tung University, Taiwan

※概要（Summary ）：
The purpose of this research is to develop high frequency (i.e. intrinsic current gain cutoff frequency (f_T) > 200GHz) HEMT for automobile radar MMIC. Observed intrinsic (f_T) of the device is about 190GHz.

※実験（Experimental）：
Two different epitaxial structures were grown on GaAs substrate. The one has channel with high indium content (60%) and the other has low indium content (40%). In device fabrication, gate metal was patterned using E-beam exposure (JBX-6300, Tokyo Tech).

※結果と考察（Results and Discussion）：
The 0.09x20um² devices with L_{SD} of 2um and In 60% channel were prepared and characterized. The measured output is shown in Fig.1. The device exhibits good pinch-off behaviors and I_{dss}=601 mA/mm at V_{DS} = 0.7V , peak Gm=846 mS/mm. Due to higher indium mole fraction, devices slightly suffer from impact ionization. RF performance was also characterized as shown in Fig.2 at V_{DS}=0.5V and V_{GS}=-0.4V. The f_T extracted by extrapolating H_{21} with a -20dB/decade slope was 190GHz.
Even though the RF performance of In 60% devices were good enough to meet the requirement of low noise amplifier, the off-state breakdown (BV_{OFF}) was not good enough for power amplifier. Therefore, lower indium content (40%) epi structure was used to enhance the breakdown behavior. The In 40% devices possess BV_{OFF} larger than 7V.

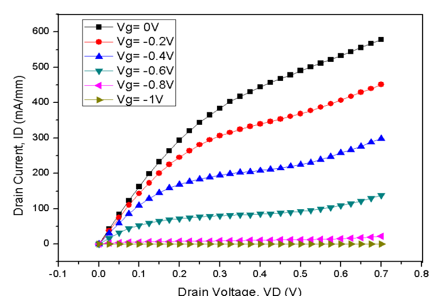

Fig.1 Output characteristics of 0.09x20um² $In_{0.6}Ga_{0.4}As$ Metamorphic HEMT

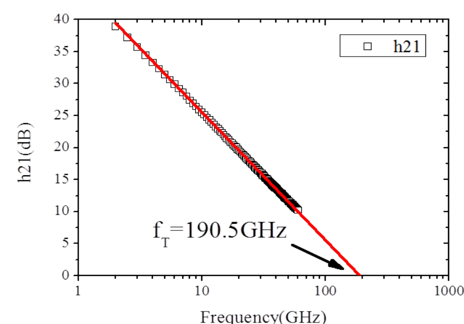

Fig.2 RF performance of $In_{0.6}Ga_{0.4}As$ MHEMTs

※その他・特記事項（Others）：
N/A

共同研究者等（Coauthor）：
Ming Huei Lin,　NCTU
Wei-ting Hsu,　NCTU
Y. Miyamoto,　Tokyo Tech
論文・学会発表（Publication/Presentation）：
None
関連特許（Patent）：None