

課題番号 : F-13-IT-0039  
 利用形態 : 共同研究  
 利用課題名 (日本語) : 低温・高周波応用の為の InAs HEMTs の研究  
 Program Title (English) : Study of InAs HEMTs for Cryogenic High Frequency Applications  
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### 1. 概要 (Summary)

60-nm InAs HEMT with  $\text{In}_{0.7}\text{Ga}_{0.3}\text{As}/\text{InAs}/\text{In}_{0.7}\text{Ga}_{0.3}\text{As}$  composite channel were fabricated and characterized for cryogenic low noise amplifier applications.

### 2. 実験 (Experimental)

The four-fingered  $0.06 \times 50 \mu\text{m}^2$  devices with InAs channel and  $L_{\text{SD}}$  of 2  $\mu\text{m}$  were fabricated following typical HEMT process with optimized gate recess and gate sinking; fine gates exposures were obtained by e-beam lithography (JBX-6300 at Tokyo Tech).

### 3. 結果と考察 (Results and Discussion)

The device exhibits  $I_{\text{dss}} = 41.8 \text{ mA}$  (209 mA/mm) and peak  $g_m = 126 \text{ mS}$  (630 mS/mm) at  $V_{\text{DS}} = 0.5 \text{ V}$ . The well-behaved pinch-off and favorable current saturation indicated that the composite channel is beneficial to the suppression of severe impact ionization in InAs channel.

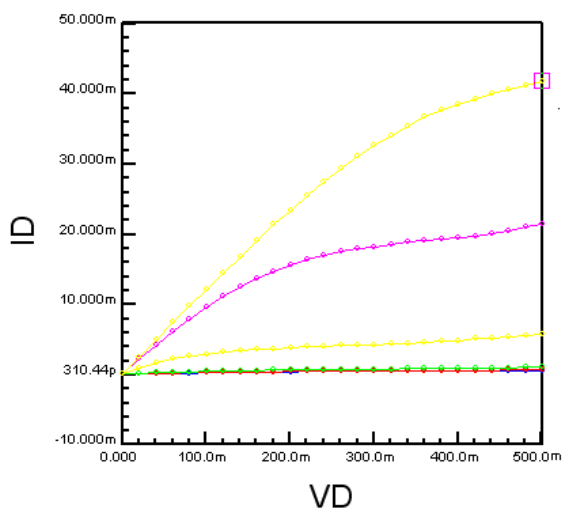


Fig. 1 Output characteristics.

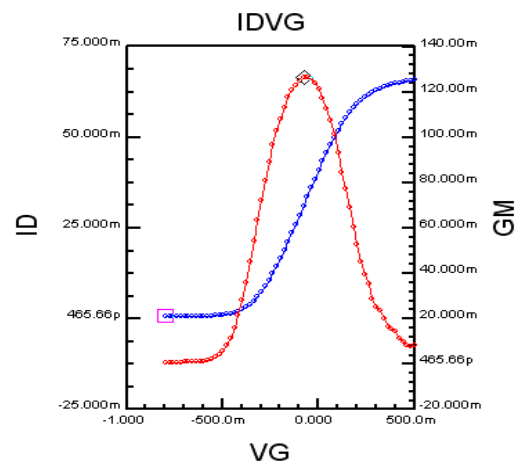


Fig. 2 Transfer characteristics.

The device also exhibits subthreshold swing of 93 mV/decade at  $V_{\text{DS}} = 0.5 \text{ V}$ , indicating that the InAs HEMT is also suitable for sub-10-nm low-power and high-performance logic applications. The cryogenic RF performance will be evaluated in the future.

### 4. その他・特記事項 (Others)

共同研究者等 (Coauthor) :  
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### 5. 論文・学会発表 (Publication/Presentation)

None

### 6. 関連特許 (Patent)

None