

# 鐵摻雜磷化銦/砷化銦鎵高電子遷移率電晶體之研製

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## 摘要

在以磷化銦為基材的場效應晶體(InP-based FETs)發展上,受限於蕭特基接觸(Schottky conatc)的品質,造成閘極的高漏電流(leakage current),因此使得磷化銦場效應晶體的特性受到限制。為提高蕭特基接觸品質,有些研究嘗試以較大能隙的砷化鋁銦(InAlAs)來提高蕭特基位障高度(barrier height),以降低閘極的漏電流。然而,大能隙的砷化鋁銦(InAlAs)材料對氧有較高的反應性,容易氧化,因此製程條件較為嚴苛,間接影響到了蕭特基接面的特性,使元件的直流與微波特性呈現劣化之現象。有鑑於鐵摻雜的磷化銦(Fe-doped InP)具有很高的電阻率(resistivity),因此本研究嘗試以鐵摻雜磷化銦作為閘極材料,希望來降低閘極的漏電流,進而提升磷化銦場效應晶體的元件特性。首先,在蕭特基接觸品質的評估上,經由I-V特性曲線的量測來獲得崩潰電壓、閘極漏電流和蕭特基位障高度。接著,進行磷化銦場效應晶體的元件製作,來進一步探討以鐵摻雜的磷化銦作為閘極材料對元件特性的影響。蕭特基二極體位障高方面,選用較高的金屬功函數(Au),從I-V特性曲線可得到有鐵摻雜的磷化銦有明顯提高,從0.65電子伏特增加到0.75電子伏特。完成製程後的電晶體經直流特性量測,其特性如下:在閘極長度(gate length)為5時,以及閘極寬度為75時,從電流電壓(IDS-VDS)特性曲線中,VDS=2.5V時,飽和電流密度為110mA/mm;在VGS=0.1V,VDS=2.5V時,可得到最大互導值為60mS/mm;元件的夾止(pinch off)電壓為-1.75V;閘極到汲極的崩潰電壓大於-4.5V。

關鍵詞:磷化銦/砷化銦鎵場效電晶體;蕭特基接觸;場效應晶體;為基材;二極體;電晶體;反應性

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