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Extraordinary Electroconductance in Ti-GaAs hybrid thin film structures[1] YUN WANG, A.K.M. NEWAZ, JIAN WU, S.A. SOLIN, Washington University in St. Louis, V.R. KAVASSERI, NIU JIN, I.S. AHMAD, I. ADESIDA, University of Illinois at Urbana Champaign — Following the demonstration of extraordinary electroconductance (EEC) in metal-semiconductor hybrids (MSHs), we have developed microscopic circular thin film GaAs-Ti EEC sensors capped by a concentric Ti electrode that acts as both a shunt and Schottky barrier. The geometrical properties of the device are characterized by the parameter α which is the ratio of the shunt radius to that of the GaAs mesa. We investigated samples with $0 \leq \alpha \leq 14/16$ in mesa sizes from 80μm to 200μm. We define the EEC as the % change of conductance with and without an externally applied electric field. An EEC=20% is obtained with α=8/16 at E=0.65kV/cm and a shunt bias current of 50nA. The reverse bias EEC is always larger than the forward bias effect (maximum $\sim$ 5%) due to the asymmetry of the band profile. The % change in sample conductance increases linearly with direct reverse voltage bias across the MS interface and is independent of the radius of the GaAs mesa. This independence is extremely desirable for scaling to the nano regime. Such a static electric field sensor as described above makes high resolution imaging of surface charge density distribution possible.

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