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Extraordinary Electroconductance in In-GaAs hybrid thin film structures[1] YUN WANG, A.K.M. NEWAZ, K.A. WIELAND, S.A. SOLIN, Washington University in St. Louis — Following the demonstration of extraordinary electroconductance (EEC) in metal-semiconductor hybrids (MSHs) in macroscopic structures, we have developed a new design for a microscopic thin film EEC sensor, which is a van der Pauw plate structure consisting of a heavily doped n-type GaAs epi layer (500nm) with metallic shunt (50nm) on top. EEC arises from the current redistribution between the shunt and GaAs when an external E field lowers the interfacial Schottky barrier height (SBH). By defining the EEC effect to be the percentage change in sample conductance with and without the E field, we have obtained a 20% change in the macroscopic sample in a field of 12kV/cm at 300K. We also compared the response of a sample with a Schottky barrier to an unshunted sample and to a shunted sample with an Ohmic interface. We propose that by applying a new surface treatment to the GaAs mesa, the surface state density can be remarkably reduced, so that the SBH is controlled by judicious choice of the metal. This allows more electron transport over the barrier and results in a geometrically enhanced conductance change. By varying the geometry of the structure and the material of the shunt, we can optimize the design of the EEC sensor.

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