Abstract Submitted
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**Plasma-produced nanocrystals enable new insights in semiconductor physics**[1] BENJAMIN GREENBERG, ZACHARY ROBINSON, CLAUDIA GORYNSKI, BRYAN VOIGT, LORRAINE FRANCIS, ERAY AYDIL, UWE KORTSHAGEN, University of Minnesota — The transition from semiconducting (insulating) to metallic behavior is a central problem of semiconductor physics. In bulk semiconductors, this insulator-to-metal transition is described by the well-known Mott criterion. However, in films of semiconductor nanocrystals the Mott criterion fails completely. Recent progress in the nonthermal plasma synthesis of films of highly doped silicon nanocrystals has contributed to the development of a new theory that presents a consistent analog to the Mott criterion for nanocrystal materials [Chen, T. *et al., Nat. Mater.* **2016**, *15*, 299]. Here, we study films of nonthermal plasma produced zinc oxide (ZnO) nanocrystals to in detail investigate the insulator-to-metal transition. We produce high-purity monodisperse ZnO nanocrystals in a nonthermal plasma and form dense films via supersonic impact deposition. We then modulate the free carrier density, $n$, and nanocrystal contact facet radius, $\rho$, via xenon-flashlamp intense pulsed light annealing, which induces necking between the clean surfaces of adjacent nanocrystals. Preliminary electrical measurements indicate that the electron mobility can be finely tuned and that the films cross the insulator-to-metal transition for sufficiently high $n$ and $\rho$.

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