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High Density Monolayer Deposition of Fine Nanoparticles for Opto-Electronic Devices XAVIER BULLIARD, WANKI BAE, KOOKHEON CHAR, School of Chemical and Biological Engineering, NSI-NCRC, Seoul National University, Seoul, Korea, SEONG JAE CHOI, JAE YOUNG CHOI, Display Device and Material Lab., Samsung Advanced Institute of Technology, Gyeonggi-do, Korea — In this study, we present a unique approach to form uniform monolayers of nanoparticles (NPs) deposited on a substrate with high surface coverage density up to $2x10^{12}$ NPs/cm^2. This was achieved through the wet coating of fine NPs with a diameter less than 10 nm. The mechanism of monolayer formation was decomposed into two stages: first the deposition driven by the electrostatic forces between a substrate and NPs and then the self-arrangement of NPs through the action of capillary forces. A physical description of the interaction forces involved in the process confirmed that for fine NPs the capillary forces are dominant over the electrostatic repulsion between adjacent NPs during drying. This enables the high compaction of a monolayer without altering its uniformity. Dip- and spin-coating techniques could as well be used for the deposition on various substrates (for example, hafnium and silicon oxides), which proves the versatility of this approach. The obtained architecture show promising properties and could be implemented for the production of the next generation of opto-electronic devices.

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