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(71) Applicant: **NANYANG TECHNOLOGICAL UNIVERSITY** [SG/SG]; 50 Nanyang Avenue, Singapore 639798 (SG).(72) Inventors: **TAN, Thatt Yang Timothy**; c/o Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798 (SG). **ZENG, Zhiping**; c/o Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798 (SG).(74) Agent: **KINNAIRD, James Welsh**; Marks & Clerk Singapore LLP, Tanjong Pagar, P.O. Box 636, Singapore 910816 (SG).

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(54) Title: MULTI-LAYERED METAL-CARBON MATERIALS-BASED NANOARCHITECTURES

Figures

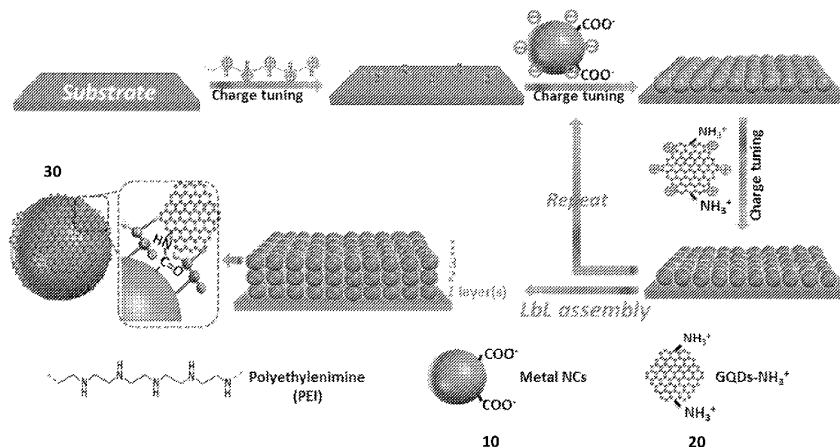


Figure 1

(57) **Abstract:** Disclosed herein is a multi-layered composite thin film material formed from graphene quantum dots (GQDs) and metal nanocrystals in a layer-by-layer design, wherein the metal nanocrystals can be selected from the group consisting of Ru, Rh, Os, Ir, Pd, Au, Ag and Pt. In a preferred embodiment, the multi-layered composite thin film material is prepared via a facile, green, and easily accessible layer-by-layer (LbL) self-assembly strategy. In this strategy, positively charged GOQDs and negatively charged metal nanocrystals are alternately and uniformly integrated with each other in a "face-to-face" stacked fashion under substantial electrostatic attractive interaction, and then the obtained GOQDs/metal composite thin film is calcined into GQDs/metal composite thin film. The composite thin film material disclosed herein may be used to catalyse a wide range of reactions, including selective reduction of aromatic nitro compounds in water and electrocatalytic oxidation of methanol at ambient conditions.

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