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Optimal Annealing Conditions, Mechanism, and Applications for the Crystallization of Titania Nanotubes Powders Obtained by Anodization EUGEN PANAITESCU, LATIKA MENON, Northeastern University, Physics Department — Titanium oxide nanotubes have drawn recent interest due to their possible application in photocatalysis, water splitting and photovoltaics, as they combine the wide gap semiconductor properties of the material with the high surface per unit volume of the nanostructures. Amorphous ordered titania nanotubes arrays can be obtained by anodization of titanium foils, and our group developed a method of ultrafast synthesis of powders containing such nanotubes bundles. Crystallization can be achieved by annealing, and we investigated the influence of annealing parameters using differential scanning calorimetry coupled with spectroscopy and imaging techniques such as SEM, TEM and XRD. Our extensive study revealed the optimal parameters for crystallization without structural damage at the nanoscale, which can occur for temperatures as low as 270 degrees Celsius. Mechanistic explanations and numerical studies offered us a theoretical insight on the phase transition process. Further employing of our crystalline powders in dye sensitized solar cells revealed efficiency results superior to those previously reported for crystallization at higher temperatures and annealing rates.

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