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Critical parameters and factors in the formation of spaced TiO_2 nanotubes by self-organizing anodization

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Abstract

Self-organized TiO_2 nanotube arrays can be grown under a wide range of electrochemical conditions. In the present work, we evaluate the occurrence of spacing between tubes and the connection of this effect to organization of tubes on two-size scales. The results show that tube-spacing is initiated in the very early stages of anodization between individual pore morphologies. Furthermore, the spacing, as well as the organization on two-size scales can be controlled by changing the anodization conditions, e.g., electrolyte composition, applied voltage and temperature. Namely, adjustment of H_2O content, electrode temperature and voltage can lead to spaced nanotubes, and allow to control spacing. Finally, we draw conclusions on possible mechanism relevant to the growth of spaced tubes.

Keyword: Anodization, TiO_2 nanotubes, Two-size scale, Spaced nanotubes