

Formation of alumina nanotubes and jet effect during high voltage local anodization of aluminum

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2021

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Keywords: Local anodization, porous alumina, honeycomb structure, alumina nanotubes, jet effect

Abstract: Using an improved heat sink from the barrier layer, the voltage of anodic electrochemical oxidation of aluminum in sulfuric electrolytes is successfully increased from the conventional limit of about 40 to 200 V. This is done by localization of the anodized regions within the windows in the niobium thin film masks with the diameters of 0.3 μm to 2.5 mm. High-voltage anodization in water solutions of sulfuric acid is observed to be accompanied by a reproducible formation of densely packed alumina nanotubes and intense gas propulsion from the pores of the forming alumina. The latter is proposed and

experimentally confirmed for use as an efficient driving agent in micro- and nanoengines. Test samples are accelerated to the velocities up to 1 cm s^{-1} , demonstrating a thrust-to-weight ratio of about 1000.

This article published in: Formation of alumina nanotubes and jet effect during high voltage local anodization of aluminum / Lazarouk S. K. [etc all] // Advanced Engineering Materials. – 2022. – Vol.24. – iss. 1. – P. 2100691. – DOI: 10.1002/adem.202100691.

Internet-link for the article:

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