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Characterization of electrochemically formed nanoscale dimple patterns by morphological and hexatic correlation analysis HUSSAIN SANGJI, SHERDEEP SINGH, McGill University, STEPHEN WANG, PETER KRUSE, McMaster University, PAUL WISEMAN, McGill University — We have previously described the emergence of ordered nanoscale dimple lattices by dissipative processes, which cover several cm^2 of the surface, during electropolishing of titanium, tungsten, zirconium and tantalum. Techniques to quantitatively characterise the properties of the surface pattern are useful for tuning the experimental parameters to generate desirable surfaces. Here we present SEM image analysis methodologies and results for the characterization of dimple patterns on Tantalum. We study morphological properties by colour coding the angular orientation of the hexagonal cells formed by the dimples with their nearest neighbours, and by labelling defects in the hexagonal lattice. We show that the morphology of the pattern is affected by the grain boundaries of the tantalum substrate and variations in its height. We also quantify the average quality of the pattern using a hexatic order parameter and spatial correlation function, and find that the quality can vary under constant electrochemical conditions according to the tantalum grain. These studies may facilitate the development of tunable self-ordered nanoscale patterns on surfaces for applications in solar cells, biocompatible materials and catalysis.

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