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Growth of Nb films on Cu substrates by direct current and high power impulse magnetron sputtering: a molecular dynamics study

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The application of superconducting radio frequency cavities on particle accelerators has brought the need of coating Cu with Nb thin films. Two techniques have been widely used in this field: conventional direct current magnetron sputtering (DCMS) and high power impulse magnetron sputtering (HiPIMS). Experimentally, the application of both techniques has led to different surface morphologies and growth. While in HiPIMS, the surface grows evenly, in DCMS grows in islands or columnar structure forms. We use molecular dynamics to explore the differences between the deposited Nb films on Cu, by mimicking the conditions of each deposition technique. Our computational model reproduces accurately the quality of the Nb-deposited films, based on several features (*e.g.* surface roughness) when compared with experiments. Moreover, we explore the differences between the two simulated methods focused on the temperature of the sample and the deposition energy, at the atomic level. Our results show that the best temperature for growing the Nb on Cu substrate in the HiPIMS method can be 750 K which leads to a more compact film layer.

Topic

Modeling and Simulations

Primary authors: GHAEMIKERMANI, Milad (University of Helsinki); LOPEZ CAZALILLA, Alvaro

Co-authors: Prof. SARAKINOS, Kostas (Department of Physics, P.O. Box 43, FI-00014 University of Helsinki, Finland); ROSAZ, Guillaume Jonathan (CERN); CALATRONI, Sergio (CERN); DJURABEKOVA, Flyura (University of Helsinki)

Presenters: GHAEMIKERMANI, Milad (University of Helsinki); LOPEZ CAZALILLA, Alvaro

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