IPAC '23

Using HiPIMS to Deposit V3Si Super Conducting Thin Films of Single Target Deposition

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V3Si is an A-15 SC that has a relatively higher Critical Temperature Tc (17 K), compared to niobium (Nb) and can maintain a higher critical field than Nb [1]. These properties would in theory allow thin film V3Si superconducting RF-accelerator (SRF) cavities to operate at higher temperatures and with greater accelerator voltages, compared to Niobium cavities. However, this would require the deposition of V3Si thin films with superconducting (SC) properties intact.

The SC properties of V3Si (as measured by RRR and Tc) is closely linked to the stoichiometry, which in turns depends on substrate composition and deposition temperature[2]. It has been shown that HiPIMS is capable of ion bombardment, during deposition, and this ion bombardment has been shown to have similar effects to sample heating[3] in allowing greater control of stoichiometry at lower temperature.

Here, for the first time, we report on the use of HiPIMS to deposit superconducting V3Si films: additionally, films are deposited from a single target rather than co-deposited. V3Si samples with a Tc of 15.1 K without the need of post-deposition annealing have already been deposited using HiPIMS. Additionally, DC and HiPIMS has been used to deposit samples under the same conditions and the use of HiPIMS increased the Tc by 2-3 K. This reopens the possibility of viable V3Si coated cavities produced by magneton sputtering .

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Footnotes

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