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On application of photothermostimulated electron emission for characterisation of Nb films, deposited on copper

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Photothermostimulated exoelectron emission (PTSE), being observed when solid specimen is simultaneously heated and excited by photons with energy close to photoemission threshold, often is related to the annealing of structural defects and hereby, could become the tool to test quality, or amount of imperfections, of the superconductive Nb films.
The present study explores PTSE of the Nb films, deposited on Cu substrates, processed by different methods: tumbling, electropolishng, chemical polishing by SUBU solution, and combination of electro- and chemical polishing. PTSE current was measured in vacuum by SEM detector; specimens were heated from 20oC to 510oC at the rate 10oC/s and excited by 4.96 eV photons.
PTSE demonstrated two peaks that could correspond to annealing of two type of structural imperfections: low temperature peak at 320 –380oC, and high temperature peak at 460 –520 oC. Each peak was approximated by Randal-Wilkins expression, and characterised by activation energy E, that was 0.58 –0.68 eV (first peak) and 0.95 –1.65 eV (second peak) for all specimens, except those with substrate, processed by both electropolishing and chemical polishing (~1.4 eV and ~ 2.5 eV)..
The interpretation of the results required additional research to understand processes, underlying PTSE, nevertheless, alterations of the activation energies indicates that structure / nature of imperfections in the Nb film is changed due to different pre- processing of the Cu substrate.
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