

Progress in the study of isotopic composition in metallic thin films that have undergone electrochemical loading of hydrogen

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Research activity began some years ago in collaboration between the ENEA (Italy) and the SRI (USA), aimed at the identification of traces of matter left by nuclear reactions in condensed matter. This work also involved cross linked analysis in order to identify effects due to contaminants that could affect the isotopic shift estimate.

Nickel thin films have been sputtered on a polymeric substrate and loaded with hydrogen by electrolysis. Reference and active thin films have been prepared contemporaneously during the same sputtering to have on both the same deposition and the same impurities composition.

Secondary Mass Spectroscopy (SIMS) has been used to analyze the isotopic composition of the electrolyzed and blank substrates.

The results indicate that a reasonably reproducible apparent shift of the isotopic composition of the Cu element occurred in some of the electrolyzed films, with an increase of mass 65, while the natural value was always observed for all the blank samples. Cu was particularly suitable for use as a marker elements because of it has only two mass isotopes (63 and 65) that do not overlap with isotopes of other elements having the same masses. The possible contribution from double ionized elements was ruled out because 126 and 130 mass elements were absent. Furthermore, during the measurements the tuning of the instrumentation on the target masses was checked by moving the argon beam to the stainless steel samples support where the Cu isotopic composition was always the natural one. Depth profile analysis has also been performed, in order to reduce the possibility of organic species surface contamination and the effect of the polymeric substrate on the measurements: an increasing of the C signal due to the substrate was coupled with a decreasing signal of other species but without any change in the Cu isotopic ratio.

In addition mass spectrometric analysis of the electrolyte revealed no evidence of organic compounds above 10 ppb, that could produce C₅H₅⁺ fragments under ion bombardment.

Despite all the above mentioned results lead to exclude a contaminant effect on the 63/65 shift a research work is in progress in order to exclude that the revealed shift is traceable to an artifact.