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Lattice sites of Fe in Al2O3 following implantation of 57Mn

Radioactive 57Mn (T½ = 1.5 min) has been implanted into Al2O3 single crystals held at 110 −666 K at the ISOLDE facility at CERN. Mössbauer emission spectra were measured on the 14.4 keV γ-rays of the daughter 57*Fe nucleis. The analysis of the obtained Mössbauer spectra reveals four spectral components listed below (see Fig. 1) assigned as follows: Dam: A quadrupole-split component assigned to Fe2+ in heavily damaged, possibly amorphous local environment created in the implantation process. S1: A single line due to Fe in cubic environment. The properties of this line are inconsistent with interstitial Fe; it is suggested to originate from Fe in nano-precipitates of ⍺-Al2O3. D1: A quadrupole-split component, which, on the basis of the hyperfine parameters and temperature dependence, is suggested to be due to Fe4+. Sx: A Fe3+ magnetically-split sextet component showing slow paramagnetic relaxation. Analysis of the line broadening of this sextet component with the method described in [1] shows it to be compatible with (slow) spin-lattice relaxations. In-depth argumentation for the assignments of components will be presented and discussed together with comparison to supportive data obtained previously from stable 57Fe [2] and radioactive 57Co implantations [3].

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oral

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