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A short cosmic-ray exposure age for an olivine grain from near-Earth asteroid Itokawa

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We analyzed the mineral composition, exact volume and He, Ne content of an olivine grain (RA-QD02-0035) brought back by the Japanese space craft Hayabusa from near-Earth asteroid Itokawa, using Raman spectroscopy, synchrotron radiation X-ray tomographic microscopy, and high-sensitivity noble gas mass spectrometry, respectively [1]. We determine $\#Fo = \sim 60 \pm 10$ (density: $3760 \pm 110 \text{ kg/m}^3$), a grain volume of $70700 \pm 1800 \text{ } \mu\text{m}^3$, resulting in a grain mass of $0.266 \pm 0.010 \text{ } \mu\text{g}$. We can resolve cosmogenic ^{21}Ne , while $^3\text{He}/^4\text{He}$ is identical (within error) to the solar wind [2]. We calculate a cosmic-ray exposure (CRE) age (GCR+SCR) of 0.5-1.9 Ma (depending on shielding), which is low compared to typical LL5 meteorite CRE ages (but similar to the CRE ages of LL5 chondrites Appley Bridge and Chelyabinsk), indicating the regolith of Itokawa is of recent origin.

[1] Meier et al., 2013, LPSC XLIV, #1937. [2] Heber et al., 2009, GCA 73, 7414 – 7432.

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