Assessing the debris generated by the small carry-on impactor operated from the *Hayabusa2* mission

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We have analyzed the carbonaceous materials generated by the explosion of an HMX (high-melting explosive) mixture in an Ar atmosphere in a laboratory simulation of the SCI (small carry-on Impactor) experiment. We used both non-destructive and destructive analytical techniques to identify the chemical nature of the materials. From SEM–EDS, we found the materials to be composed mainly of carbon, nitrogen, and oxygen, with a detectable amount of metals. Suitable parameters for identifying these materials are a FTIR peak at 1520 cm^{-1}, low reflectance and gentle red slope of FTIR spectrum compared with a Murchison CM2 chondrite, the Raman D and G bands, and the H, C, and N isotopic compositions and their spatial distributions. The scanning transmission X-ray microscopy (STXM)–XANES results provided the molecular nature of these highly aromatic materials, which was supported by results from TD–GC/MS. These results suggest that it is possible to distinguish either Ryugu samples or SCI materials as potential contaminants in a sample container by using proper combinations of analytical techniques. This assessment provides information useful for the analysis of the Ryugu asteroidal samples.

Keywords: C-type asteroid Ryugu, Hayabusa2 mission, Off-nominal assessment, Small carry-on Impactor, Carbonaceous materials

