Contribution ID: **348** Type: **Poster**

Neutron activation analysis (NAA) reveals "fingerprint" of materials: From microchips to meteorites

Tuesday, 18 September 2018 17:15 (15 minutes)

With its very pure thermal neutron flux, the reactor FRM II at Garching offers very good opportunities for studies of chemical composition in samples. The advantages of the instrumental NAA (INAA) are simple sample preparation without chemical handlings, high sensitivity, multi-element capability at all concentration levels (main, minor & trace) and almost non-destructiveness. The so-called "fingerprint"method, especially analysing rare earth elements (REEs), can give us e.g. more details of the provenance of the samples.
INAA is applied in material science e.g. quality assurance of semi-conductor materials. Impurities in the sub-ppb-level (1:10^9) can be detected after long-time irradiation with high neutron flux (> 10^{14} $cm^{-2}s^{-1}$).
One of the interesting interdisciplinary projects is the bulk analysis of meteorites. Among them is the stony meteorite "Cloppenburg", which was found in 2017 as the 49^{th} German meteorite [1]. More than 45 elements could be determined by INAA [2]. The INAA data is mandatory for the interpretation of cosmogenic radionuclide data determined by accelerator mass spectrometry (AMS) [3] to reconstruct the history of the meteorite(s) such as irradiation and terrestrial age, and preatmospheric size.
Ref.: [1] Meteoritical Bulletin, no. 106, in prep. (2018). [2] X. Li et al., Proc. of Paneth-Kolloquium (2017). [3] S. Merchel et al., this meeting.

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Session Classification: Poster session 2

Track Classification: P1 Instrumentation and methods