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Forensic study of early stages of the Chernobyl accident: story of three hot particles

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Highlights

- Results of the investigation of three contrasting hot particles from the first fraction of ejecta of the Chernobyl accident are presented.
- Application of complementary methods provides new information about structure of the Chernobyl hot particles.
- Some of the particles consist of complex mixture of Zr-U-O phases often with minor Fe admixture from spacer grids, reflecting processes preceding explosion of the reactor.

Abstract.

Three contrasting hot particles ejected from the core of the 4th Unit of Chernobyl nuclear power plant at an early stage of Chernobyl accident were studied using complementary analytical methods: including γ-spectrometry, SEM-E(W)DX, EBSD, Raman spectroscopy and Secondary Ions Mass Spectrometry. The particles span range from dispersed UO_{2+x} fuel to a fragment of zirconia with traces of U and to chemically and structurally complex Zr-U-O particle. These particles represent wide variety of processes in the reactor during the accident development and likely originate in spatially distinct domains. Whereas the fuel particle is virtually unaltered, the