RADES (RAdiological Dispersion Events Set-up) set-up and result from the characterization of the aerosol from simulated RDE´s (Radiological Dispersion Events).

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Evaluation of the source term, which means to perform a quantitative analysis of the radioactive release (including both the description and quantification of the gaseous species and aerosol particles release), is of main importance for risk assessment and emergency response in case of accident or sabotage involving nuclear material or radioactive sources. Many codes (such as ARGOS, RODOS, HOTSPOT) are available to evaluate the extension and levels of contaminated area after a radioactive releases. These codes need however of a quantitative assessment of the source term as input for their calculation.

A new experimental set-up (RADES) for the characterization of aerosol formation has been developed, to support the need of a better understanding of the source term related to RDE's with experimental data. In our experimental set-up we simulate RDE's by applying different thermal transients to sample materials. These materials have been chosen because they are widely used in commercial applications, such as nuclear medicine, sterilisation, or nuclear energy. Thermal transients are applied by a Nd:YAG continuous wave laser emitting at 1064 nm. The power of the laser is control in our experiment through a PID controller (Proportional, Integral, Derivate controller), the set point of the controller has been set to a quasi square temperature pulse. The created vapour forms aerosols by condensation in a cooler controlled environment; these aerosols are then collected by different systems (MOUDI impactor or MILLIPORE filters) for post analyses (e.g. size distribution, chemical and elemental composition). Techniques applied included SEM/EDX, ICP-MS, RAMAN.

In this presentation the results from the test performed on Co, CsCl, CsI and simulated nuclear fuel (consisting of a ZrO_2 matrix doped with chemicals simulating fission products BaO, Pd, CsI) will be presented, also the influence of different gases (Ar and ambient Air) on the aerosol formation will be shown. The results from the chemical analysis (ICP-MS and SEM/EDX) on the aerosols will be presented during the talk. For what concern the SEM analysis similarity in size distribution and form of the agglomerates was observed between the aerosol Co and ZrO_2 and between CsCl and CsI. The former show the formation of two types of aerosols: spherical individual particles with a diameter >1 μm and "string" structures formed by particles in the range of 50-300 nm. Influence of the chosen atmosphere was strongly shown for the Co and could be related to difference between the vapour pressure of metallic and oxidized Co. The salts (CsCl and CsI) on the other hand present as well a similar behaviour, showing particles of a mean bigger diameter and tendency to created spherical and independent particles. Strong coagulation phenomena were seen when the power applied was higher and high releases were observed.

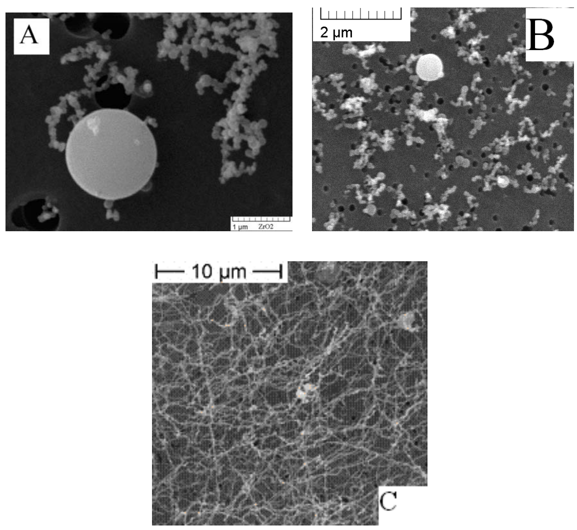

Figure 1. Example of aerosols collected from A) ZrO_2 B) and C) Co, showing similarity in size and form; Co aerosol where formed B) in air atmosphere and C) in Ar atmosphere, showing the influence of the atmosphere in particles agglomeration phenomena.

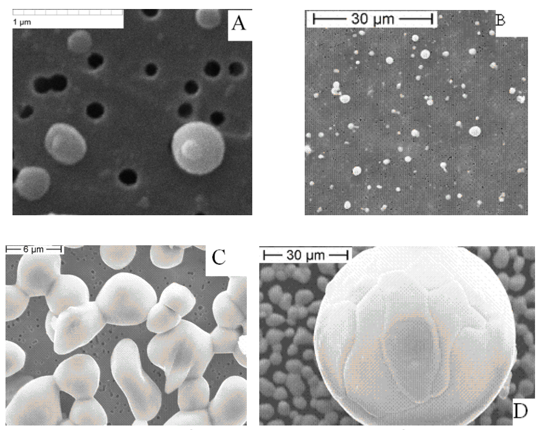

Figure 2. Example of aerosols collected for CsI, showing A) and B) spherical individual aerosols; C) and D) strong coagulation phenomena.

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