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Collapse of mesoporous silicas induced by radiation damage - New prospects for nuclear waste treatment

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Considering their large interfacial surface, nanoporous materials offer interesting perspectives for the study of the evolution of damage induced by irradiation [1]. In order to study this phenomenon, thin films and powders of mesoporous silica (SBA15, MCM41) produced by sol-gel process were respectively irradiated with ions (Au, Xe...) and electrons (0.5 - 2 MeV). Different techniques have been implemented (BET / BJH, SAXS, RRX, microscopies, IR, NMR, etc.) to characterize the porous network as well as the silica walls of these materials according to the irradiation conditions (fluence, energy). In all cases, significant compaction of the porous network was observed, inducing a collapse of the mesoporosity [2-3]. The presentation aims to discuss these different observations, and clarified the role of interfaces on the evolution of defects created by irradiation.

From a technological point of view, mesoporous silica grafted with a selective organic ligand would allow both the separation of RadioNuclides and their encapsulation after collapse of the porosity by radiation damage. This new concept envisaged for the management of radioactive effluents would lead to a conditioning matrix for radioactive waste. Preliminary results obtained during tests with solutions containing $^{238/239}$Pu will also be presented.

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