UNIVERSITÀ DI PARMA

Dipartimento di Scienze Matematiche, Fisiche ed Informatiche - DSMFI

Colloquium

Damaging of limestone and siliceous concretes at high temperatures

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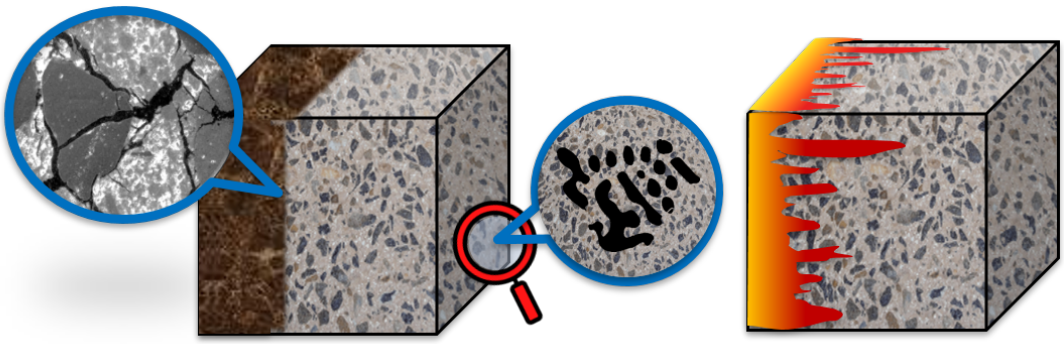
In case of a severe nuclear accident, as it occurred in Fukushima-Daiichi in March 2011, a complex and aggressive liquid mixture called corium is produced. It is constituted mainly of nuclear fuel materials and is formed at high temperature (T>3000K). In absence of cooling, this nuclear magma can interact with all the existing components of nuclear reactors and in particular with the concrete of the reactor pit, last confinement barrier before dissemination in environment. In such situations, Molten Core Concrete Interaction (MCCI) occurs. MCCI experiments with siliceous and the sand-lime concretes have been conducted with oxide/metal prototypical mixtures in the VULCANO facility at CEA-Cadarache (France). One outcome is that the understanding of the behavior of the metallic phase still needs to be clarified. Both experimental and numerical studies have been carried out to propose new insights into this problem. In this seminar, results on siliceous and sand-lime concretes, representative of the French nuclear power plants, will be presented. Characterization of concrete damaging after thermal stress with mercury porosimetry and thermo-gravimetric will be discussed together with scanning electron microscopy measurements. These latter evidence unexpected corium patterns that suggest the occurrence of specific heat propagation mechanisms. Finally, simulations of a basic model will illustrate short time evolution of MCCI and evidence the possibility for strong wetting phenomena to come into play.



Giovedì 12 Marzo 2020 – ore 16:30- Aula Newton – Plesso Fisico