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Materials behavior under extreme conditions (APPA)

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The BIOMAT beamline at FAIR will make possible materials science experiments with unprecedented heavy ion beams intensities. One of the central research directions will focus on the field of materials in high radiation fields, temperature and pressure conditions, using fast extracted, high-intensity beams. Future studies of materials behaviour in extreme environments will have a direct application to the development of accelerator components, the understanding of structural materials degradation in next generation fusion and fission reactors or the shielding of equipment and humans in deep space missions. Testing of innovative materials solutions for components for the future high–power accelerator facilities like FAIR, High Lumi-LHC, FRIB, neutrino factories and ESS, for ITER and for ESA missions in conditions of radiation, temperature and pressure reproducing operation scenarios will be possible. The availability of a high power laser at the BIOMAT beamline would make possible pump-probe experiments using laser based diagnostic, enabling online structural degradation studies during irradiation and ion-beam driven shock experiments, as well as studies on the dynamics of radiation defects on a much finer time scale, a path-breaking direction in the study of materials modification with ion beams.

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