MAT Science Week
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Investigations and modifications of selected thin films by 1-2 MeV rare-gas ion beams

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We used 1-2 MeV rare-gas (He, Ar, Kr) ion beams to study and modify the surface and interfaces of thin films of materials with a high potential for applications, such as magnetite Fe3O4 (spintronic devices/sensors at room temperature), titanium oxynitrides TiNxOy (photocatalysis), Ti/V and their oxides-based films (hydrogen storage), uranium nitride UN (nuclear fuels), highly-ordered Pd-Fe alloys (high-density recording materials). We show e.g. that: 1) the stoichiometric Fe3O4 layer on the film surface of the bi-layered of Fe3O4/Fe/MgO(001) films could be well preserved upon Ar+ and Kr+ ion irradiation with e.g. ion fluence of 3.8x10^16 Kr/cm2, while such ion fluence has induced a complete oxidization of the Fe layer, 2) hydrogen amount up to 40-50% can be stored in the Ti layers while it diffuses without accumulation through the TiO2 layer and covering the film surface by palladium would lead to a large increase of hydrogen concentration indicating that Pd could act as a good catalyst, 3) a large hydrogen absorption can be obtained in the V2O5-TiO2 films but hydrogen absorption can induce V2O5-VO2 transition 4) 1 MeV Ar+ ion irradiation could restore the stoichiometry 1:1 and as a consequence increase the total film thickness of UN films, 5) the Pd or Fe layer can survive Ar+ ion irradiation at low damage levels, while the thermal treatment caused a large change of surface morphology.

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