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Investigations on Cs dispersion and Mo coating on SPIDER components

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SPIDER is the 100 keV full-size Negative Ion Source prototype of the ITER Neutral Beam Injectors and it is operating at Consorzio RFX in Padova, Italy. It represents the most powerful Negative Ion Source in the world. SPIDER works with RF plasma from which Deuterium and/or Hydrogen ions are produced and extracted. At the end of 2021, a scheduled long-term shutdown started to perform major modification and improvements aiming to solve issues and drawbacks identified during first years operation. First action of the shutdown period was, the disassembly and characterisation of SPIDER beam source after removal from vacuum vessel and its positioning inside the clean room,. Each component was carefully observed, catalogued and the whole procedure has been documented.

Some source components, i.e. Plasma Grid, Extraction Grid, Bias Plate, revealed the presence of different and non-uniform red, white and green coatings that might be correlated to back-streaming positive ions impinging on grid surfaces, electrical discharges and caesium evaporation. Thus, several analyses have been carried out to understand the nature of such coatings and the study is still ongoing. The evidence of caesium evaporation and deposition, such as the formation of oxides and hydroxides, on molybdenum coated SPIDER components is presented by means of surface characterisation analyses like Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD) and X-Ray Photoelectron Spectroscopy (XPS).

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