3D Rarefied Molecular Flow Simulation To Understand Measurements Performed In Deuterium Plasmas

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Abstract

Molecules of deuterium in particular rotational and vibrational states are involved in non-equilibrium chemical reactions in tokamak or in neutral beam injector to produce negative ion D-. These molecules are produced in a complex plasma phase where electrons, ions (positive and negative), molecules, atoms, photons interact with each others and with plasma-facing surfaces. The DESIRS beam line at the SOLEIL synchrotron (Saclay, France) allows an accurate investigation of these Deuterium states and could explain where they are more likely created. However, these measurements also unveil a depletion of these molecules between plasma-ON and plasma-OFF conditions. A 3D modeling of rarefied flow of D2 molecules in the experimental structure helps to find a possible explanation of this observed depletion.