Structuration of surfaces and 2D materials induced by swift heavy ion irradiation at grazing incidence

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Date de la soutenance
05/02/2024 à 09:15

Lieu de la soutenance
Université de Caen Normandie - salle des thèses- Bâtiment Science 3 - Campus 2 - Côte de nacre Boulevard Maréchal Juin 14032 Caen Cedex 5.

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Abstract
Materials modification has enabled significant advancements in the technological fields by allowing for precise control and manipulation of material properties. To ensure successful applications, it is crucial to have techniques that offer control over the size, shape, and morphology of the structures created. This thesis explores the use of swift heavy ions (SHI) to create nano- and microstructures on the surfaces of strontium titanate ($SrTiO_3$) and molybdenum disulphide (MoS_2) under grazing incidence geometry. The results show that SHI irradiation can induce various surface modifications, such as elongated surface defects, wave-like structures, and amorphization. This research demonstrates that by adjusting the fluence and angle of incidence of the ion beam, periodic wave-like structures can be formed on the surface of $SrTiO_3$. These structures can be deepened to obtain more pronounced valley, which can be used to directly grow two-dimensional materials and obtain heterostructures with well-defined interfaces. The results also demonstrates that SHI irradiation can induce foldings in MoS_2 samples. The angle of incidence of the ion beam and the substrate used can control the defects. The choice of substrate can also influence folds density and length. It is shown that using $SrTiO_3$ as a substrate allows the folding with variable lengths without the need for specific crystallographic orientation conditions