Mechanical properties of widely applicable thin nanocrystalline films have been a subject of interest for some time due to deviation of their properties from the properties of bulk and micro sized grain materials. The deformation mechanisms in these materials are altered by restricted size of the material and high ratio of surface and grain boundary areas. Recent advances in transmission electron microscopy (TEM) allow direct observations of the deformation mechanisms during nanoindentation or tensile deformation of the specimen. Thin Al films prepared by DC magnetron sputtering were deformed in situ in TEM and bright field TEM. High resolution TEM and automated crystallographic orientation mapping (ASTAR) were implemented to observe the ongoing deformation mechanisms. Molecular dynamic simulation designed to approach the conditions of performed experiment were used to visualize the deformation mechanisms on atomic scale and the reliability of both methods was discussed.