Increasing the catalytic activity of molybdenum carbide for graphene growth via molybdenum layer properties

Seda Kizir[1], Wesley van den Beld[1], Robbert van de Kruijs[1], Jos Benschop[1,2], Fred Bijkerk[1]
[1]*Industrial focus group XUV optics, MESA+ Institute of Nanotechnology, University of Twente, Drienerlolaan 5, 7522 NB, Enschede, The Netherlands*
[2]*ASML Netherlands B.V, Veldhoven, Netherlands*
s.kizir@utwente.nl

Chemical vapour deposition (CVD) is known as the most promising route for industrially applicable wafer scale graphene synthesis. The CVD process mainly relies on the decomposition of a gaseous carbon source on a metal catalyst at high temperatures. Due to the e.g. inhomogeneous out-diffusion of carbon and metal groove formation, uniform graphene synthesis is still challenging. A new promising catalyst for uniform mono and multi-layer graphene synthesis with high temperature stability is Mo_2C, having noble metal like catalytic properties and low cost[1,2].

Unlike traditional graphene catalyst materials, Mo_2C is not directly deposited but is formed by a rapid transformation of a Mo layer directly after exposure to CH_4 at high temperature. The properties of the initial Mo layer, such as purity and density, are critical for the formed Mo_2C structure and also the subsequent graphene nucleation. Previously, the number of graphene layers showed to be different for Mo foils and thin films[2] but the influence of the Mo properties is not investigated. In this work, the relation is studied between graphene growth and the properties of the as deposited Mo layers before CVD, in particular the effect of Mo oxygen content and density.