In situ study of electron beam induced InAs nanowires dissolution in de-ionized water by liquid cell transmission electron microscopy

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A large portion of reactions and evolutions happens in liquid. However, study materials and processes in liquid with high spacial resolution is still challenging. Recently developed liquid cell transmission electron microscopy (TEM) provides a powerful way for these study. Although the change of nanoparticles in liquid have been studied by several groups, the change of nanowires (NWs) in liquid has seldom been directly observed with high resolution by TEM. InAs is an important III-V semiconductor with high mobility, high electron injection velocity and small bandgap, and is easy to form ohmic contact with metals. InAs nanowires (NWs) have great potential in electronic, optical, and photoelectronic fields. In this work, InAs NWs dissolution process in radiolytic water is studied by *in situ* liquid cell TEM for the first time. Surprisingly, we find the dissolution rate is constant during the whole dissolution process even when the diameters of the InAs NWs decrease to several nanometers. The mechanism of this phenomenon is studied considering the concentrations of the reactant and product, and their diffusion. The MOCVD grown NWs, which contain more defects, are found to dissolve more quickly than MBE grown NWs.