Surface tension of Au-catalysed GaAs-nanowires

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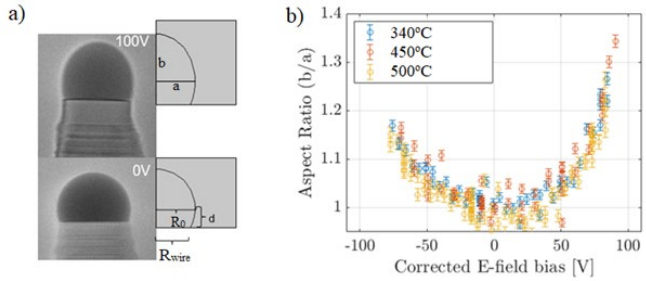
Droplets are held together by the surface tension, which is the force from the surface molecules attracting each other. It is not only the phenomenon explaining droplet formation, but it is also an important factor, when studying vapor-liquid-solid growth, which is a commonly used growth mechanism for nanowires. Today however, growth models and predictions are based on approximate values of the surface tension, lacking in reports of empirical values e.g., for Au-catalyzed GaAs-nanowires.

An external electric field has previously been used to deform the catalyst droplet on AuSi eutectic droplets on silicon nanowires and the balance of field and surface tension can be used to measure the surface tension. Here, we use a similar procedure growing Au-catalyzed GaAs nanowires on microfabricated Si-cantilevers, which opens up for many types of in-situ experiments, deforming the catalyst in an arsine atmosphere using a unique ETEM with a purpose-built gas injection system.

Image analysis and 3D simulations (Fig. 1a) using COMSOL Multiphysics are used to compare the droplet shape e.g., the aspect ratio of the droplet at various fields and temperatures (Fig. 1b) reporting an empirical value of the surface tension for the first time and with improved analysis also an updated value on the AuSi surface tension reported earlier.
In conclusion, an empirical value of the surface tension of the AuGa eutectic of GaAs nanowires is reported using locally heated Si-cantilevers in an ETEM. This will be compared with theoretical predictions.

Graphic:



Keywords:

GaAs-nanowires, catalyst, surface tension, MEMS

Reference:

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