

Influence of substrate treatment on the growth of advanced core–shell alloys and compounds of FeSi@SiO₂ and SiO₂ nanowires

Sibongiseni Thabethe^{a,b}, Christopher J. Arendse^b, Bonex W. Mwakikunga^{a,c},

^aDST/CSIR National Centre for Nano-Structured Materials, P.O. Box 395, Pretoria 0001,
South Africa

^bDepartment of Physics, University of the Western Cape, Private Bag X17, Bellville 7535,
South Africa

^cDepartment of Physics and Biochemical Sciences, University of Malawi, The Polytechnic,
Private Bag 303, Chichiri, Blantyre 3, Malawi

Abstract

Advanced core–shell FeSi@SiO_x nanowires are observed when FeCl₃ vapour is made to flow over a SiO₂/Si substrate at 1100 C. The thickness of the SiO_x sheath (d_0) is found to depend inversely as the period of time of HF etching of the SiO₂/Si substrate. When such substrates are overlaid with a thin film of Au, the nanowires obtained are found to be pure SiO₂. The Au layer disappears as vapour of AuCl₃ as its melting point is at 298 C. Proposed mechanisms of growth in all the various scenarios are identified to be governed by self-catalyzed vapour–solid (VS) mechanism.