

Fracture in Core-shell Si-SiC Nanotowers

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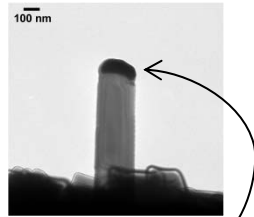
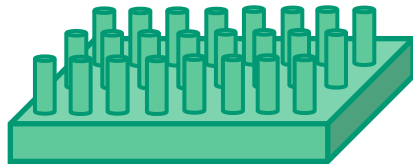
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Facilities utilized: Nanofabrication Center and CharFac JEOL 6500 SEM

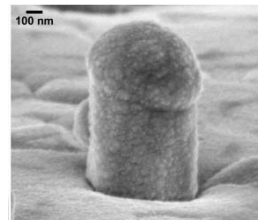
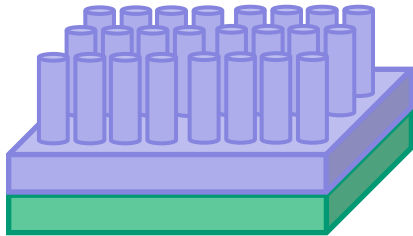
- Si-SiC composite nanotowers were grown to study the small scale confinement of Si
 - ◆ Si nanotowers were grown using VLS
 - ◆ Nanocrystalline SiC was deposited using hypersonic plasma particle deposition (HPPD)

VLS Si nanotowers

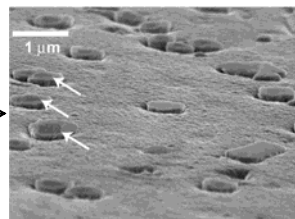
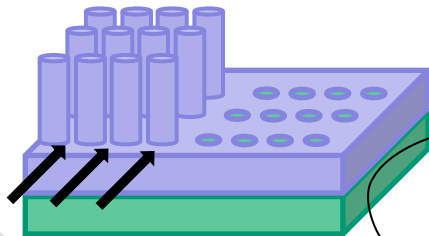


Au catalyst

HPPD nc-SiC coated Si



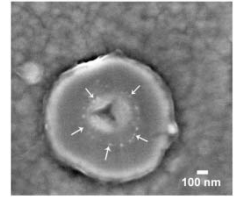
Focused ion beam milling



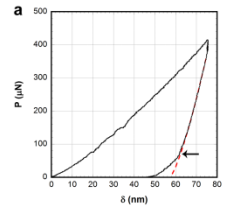
Core-shell structure exposed

- Nanoindentation used to probe confined Si core

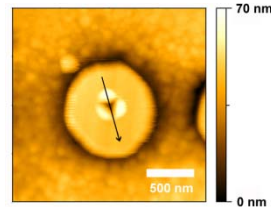
- ◆ Indentation induced cracks at indenter vertices confined to the Si core due to compressive stress imposed by SiC shell



- ◆ Deviation from elastic-plastic unloading suggests Si phase transformation



- ◆ AFM height scan shows significant plastic pile-up at indentation edges



- ◆ Increased composite toughness due to ductile phase pinning and phase transformation toughening

- Publications

- ◆ Beaber, A.R., S.L. Girshick, and W.W. Gerberich. "Dislocation plasticity and phase transformations in Si-SiC core-shell nanotowers," *Int. J. Fract.*, (in press).

- Funding

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