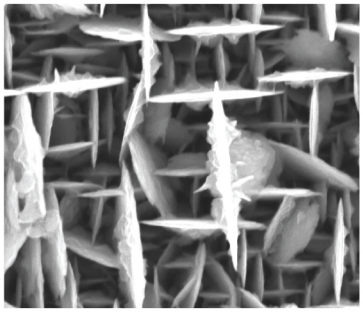
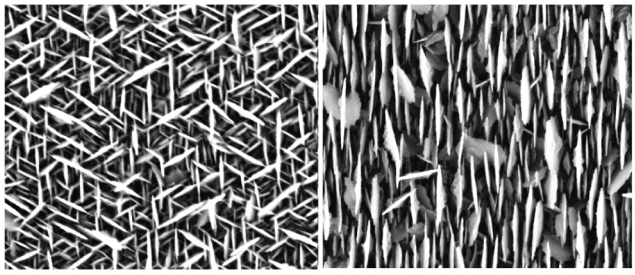
High Surface Area Fuel Cell Substrate

Crystallographically-aligned, nanoscale Cobalt (Co) discs can be electrodeposited on GaAs (110), (111) and (001) single crystalline substrates from dilute cobalt sulphate and ammonium sulphate solution. The discs are single crystalline hexagonal-closed-packed (HCP) in structure, and epitaxially aligned with their c-axisparalleltothein-planeGaAs (110) directions in each case.[1]



The thickness of these discs is about 50 nm. Their spacing and surface area can be controlled by the electrolyte conditions.

Uniaxial alignment is feasible by using (110) substrates.



The Problem

Fuel cells require high surface area electrodes, which are compatible with Pt catalyst particles. The large surface area of these Co discs may be useful as a viable electrode support. Spintronics applications require efficient spin injection into semiconductors such as GaAs. The Co discs provide a porous mag- netic material that has an easy axis of magnetization perpendicular to the surface, or in-plane, if required.

The Need

Fuel cells require more efficient electrode materials that allow rapid access to the catalyst and outflow of reaction products. The Co nanodisc structure allows for a controllable porosity with high surface area to attach to or deposit the catalytic material.

The Alternative

There are no other ways to deposit these Co nano-discs. Planar, epitaxial Co/GaAs layers can also be structured by electrodeposition or in vacuum-based systems whereby the metal is evaporated or physical-vapour deposited (sputtered) onto thesurfaces. These layers are body-centred cubic, planar layers, which may or may not be single crystalline depending on the preparation of the substrate and temperatures. The formation of self-aligned, HCP Co nanodiscs is unique to our electrodeposition process.

The Benefits of SFU Technology

The process is comparatively inexpensive in both hardware and production/process time. The high surface area of the Co discs will be useful for catalyst attachment in electrodes. Perpendicular or planar magnetization of the Co is feasible and useful for spintronics applications.

Partnering Opportunity

SFU is looking for partners who want to implement self-assembled Co nanostructures. SFU believes this is of particular interest to:

- Fuel cell manufacturers
- Spintronics developers.

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References

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