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Measurement of BET Surface Area on Silica Nanosprings

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Measurement of BET Surface Area on Silica Nanosprings

TAP program for Go-Nano

Abhi Karkamkar

Manager: Gary Spanner

Dr. Norton from Go Nano contacted the TAP with intent to measure the BET surface and hydrogen absorption potential of the materials composed of silica nano springs loaded on substrate. The initial problem with these materials is that it is not straightforward to determine the BET surface of materials on substrates. The weight of the materials deposited on the substrate is significantly smaller than the weight of the substrate. After a couple on unsuccessful measurements on thermogravimetric analyzer to determine hydrogen desorption during thermal treatment we decided to pursue BET surface measurements.

Initial attempts were performed on a substrate material with lower loadings which made measurements more susceptible to errors. After communicating with Dr. Corti and Dr. Kinkeade at Go Nano we decided to pursue the BET measurements on a fresh batch of samples with higher loadings and much better understanding of the amount of nano springs deposited on the substrate.

BET measurements are performed using an Autosorb surface area analyzer. The measurements are more routinely performed on powders or monoliths and more recently on thin films. BET measurements are based on Langmuir isotherms and on an equation formulated on Brauner, Emmett and Taylor. The isotherm is measured at 77 K (-196 °C) using a liquid nitrogen bath. The measurement consists of 78 points (40 adsorption and 40 desorption points) out of which eleven points in the range of P/P_o of 0.01 to 0.2 are

used for estimating the surface area. Figure one shows a plot of the isotherm constituting the N_2 isotherm. Figure two shows the BET surface plot obtained from the N_2 isotherm in figure 1. The surface area is for the sample is 262 m²/g. I conveyed the results to Dr. Corti at Go-Nano after completing an ERICA request on the data.

Figure 1. Nitrogen adsorption desorption isotherm for Silica nanosprings (GoNano2) samples deposited on substrate. The isotherm was obtained at 77 K using liquid N₂ bath. The area of the substrate is 16 cm^2 . The amount of the sample is 0.44 mg/cm^2 . Amount of silica nanosprings= 7.04 mg. There is no indication of substantial micro or mesoporosity in the sample based on the nature of the isotherm.



Figure 2. BET surface area plot for silica nanosprings (GoNano2) samples deposited on substrate. The isotherm was obtained at 77 K using liquid N_2 bath. The area of the substrate is 16 cm². The amount of the sample is 0.44 mg/cm².

Amount of silica nanosprings= 7.04 mg. Eleven point BET surface area was measured.

Nine points plotted. Goodness if fit R= 0.9992

BET surface area for silica nanosprings= $262 \text{ cm}^2/\text{g}$

