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Formation and Characterization of Gold Nanostructures

In previous studies, the Beebe research group has learned how to produce small circular pits in graphite known as "molecule corrals," varying in size from 100-1000nm in diameter that can be used as templates to form metallic nanostructures. As the gold is deposited by vacuum evaporation and annealed at high temperatures (300 - 500°C), the atoms begin to congregate along the edges of these graphite pits and grow upwards to form mesa-like structures.

In this particular study, the influence of temperature on the formation and growth of these gold nanostructures was studied using scanning tunneling microscopy (STM). Three separate trials were performed by successively increasing the annealing temperature from 300 - 500°C, in intervals of approximately 50°C. After each annealing, the samples were imaged and characterized by STM to measure the height and diameter of the resulting nanostructures.

While these three trials yielded a large amount of data, only qualitative results have been achieved. The trials indicate that while the structures do indeed grow in height as annealing temperature is increased, the diameter of the structures has been too

order to fully understand this annealing temperature dependence.

One of the more unexpected results was the effect that deposition temperature had on nanostructure formation. In the two trials in which the gold was deposited at 300°C and 350°C, the nanostructures appeared and grew more or less as expected. However, when the gold was deposited at room temperature the nanostructure formation was significantly hindered, even after high temperature annealing.