Laser Annealing of Silicon Clusters

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Three years ago in an earlier communication from this laboratory evidence was presented that certain clusters of silicon were special. In particular that positively charged clusters of silicon with 21, 25, 33, 39, and 45 atoms were found to be relatively unreactive toward chemisorption of ammonia, while clusters with only one atom more or less reacted rapidly. This striking observation led to the suggestion that silicon clusters in this size range may adopt special geometrical forms, and a considerable amount of activity has since resulted amongst theorists in considering just what these special forms may be. This is a matter of substantial importance since structure is a critical aspect of chemistry. If small clusters of such element as silicon are to be useful as a model of the surface chemistry of the bulk, it will be necessary to find a reliable way to anneal them to a well-defined structure. We report here evidence that such annealing is possible through the use of laser excitation of the clusters levitated in the magnetic field of a Fourier transform ion cyclotron resonance (FT-ICR) spectrometer.