Nano-Electro-Mechanical Systems (NEMS) At Delft

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We have fabricated suspended structures of single-walled carbon nanotubes and semiconducting nanowires (InP). In our doubly clamped suspended nanotubes, we use charging effects to study the interplay between mechanical and electrical properties. Single electrons tunnel onto suspended nanotubes and induce a quantized mechanical displacement. Consequently, the conditions for resonant tunneling depend on the mechanical and electrical properties resulting in a displacement of the nanotube. This *single-electron induced mechanical* motion offers a unique opportunity to measure the eigenfrequencies of vibrational modes by means of phonon-assisted tunnelling processes. The longitudinal, stretching modes of the tubes have been detected in this way. With the suspended, singly clamped semiconducting nanowires we have fabricated switches. Results of manipulating them with atomic force microscopic will also be shown.

We have also started the top-down fabrication of NEM-devices using the NAF-DIMES facility at Delft. It consists of scaling down the existing micron-size MEMS technology far into the sub 100 nm range. Ultimately, we aim at integrating measurement electronics on the same chip as the NEM-device to minimise parasitics, and reduce or eliminate interface connections thereby improving signal integrity and measurement accuracy.