# Review of: "Real-time nanomechanical property modulation as a framework for tunable NEMS"

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This is a very interesting work that leverages both the unique material properties offered by this 1D PCM GeTe and the mechanical degree of freedom in such NEMS devices.

This works is to some extent both similar to and different from an earlier experimental work on NEMS resonator based on nanowires of $VO_2$, another PCM (10.1021/nl402116f). Instead of using temperature to control the phase transition, in this work electrical current is used to switch the PCM between crystalline and amorphous phases. While the Young's modulus is lower for the amorphous state as most people would expect, one interesting observation is that the quality factor is about the same for both states. Typically the amorphous phase is expected to exhibit increased dissipation due to the creation of the domain boundaries/walls and possibly dislocations as well as defects embedded in them.

Another interesting frequency tuning effect demonstrated in this work is the use of current pulses to generate defects in the nanowire, which could further be reversed by Joule annealing. It seems that applying pulses with alternating polarities results in very different frequency tuning behavior than using pulses with the same polarity. In the case of alternating pulses, the resonator exhibits three distinctive frequencies as the resistance take three different values, with the lowest value even lower than when (presumably) the entire nanowire is in the amorphous phase. In the case of unipolar pluses, frequencies for the latter two resistance states are nearly the same. It would therefore interesting if one can examine the actual distribution of defects as the resistance and the resonant frequency change, using probes offering spatial resolution such as TEM or Raman microscopy (if practical). Such new studies might offer additional insight into this interesting aspect (why the polarity of the pulses can make such difference), and better relate the creation of defects using electrical pulses with the amorphization process.