# Multicracking and magnetic behavior of magnetic nanowires/polymer substrate systems

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This work presents the effect of large strains (up to 20%) on the behavior of magnetic nanowires ($Ni_{80}Fe_{20}$ and $Ni_{60}Fe_{40}$) with a thickness of 20 nm deposited on a Kapton substrate.For that purpose, 0.5×0.5 $cm^2$ arrays of nanowires have been fabricated on 125 $\mu$m thick-rectangular (0.6×4.0 $cm^2$) Kapton substrates. Note that no adhesion layer (Cr, Ti, ...) has been deposited on the substrate in order to avoid their influence on the possible initiation of cracks in the nanowires. The multicracking phenomenon was followed by in situ tensile tests combined with atomic force microscopy measurements. These measurements show, on the one hand, a delay in crack initiation relative to the nonpatterned thin film and, on the other hand, a saturation of the length of the nanowire fragments. The magnetic behavior has been analyzed by using ferromagnetic resonance technique. The ferromagnetic resonance line profile (intensity, width) in the case of $Ni_{80}Fe_{20}$ is minimally affected by the numerous cracks, which is explained by the small variation in magnetic anistropy and the low magnetostriction coefficient of $Ni_{80}Fe_{20}$ [1,2] while it is strongly affected in the case of $Ni_{60}Fe_{40}$ nanwoires. Indeed, in the case of Ni60Fe40 nanowires, the initial shape anisotropy is completely compensated by the applied strains.

**References:**

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*Authors would like to thank CNRS and the National University of Singapore for their support through the International Research Program (IRP) Stretch-Smart*