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***In-situ* study of AFM tip wear by contact resonance force microscopy** JASON KILLGORE, ROY GEISS, DONNA HURLEY, National Institute of Standards & Technology — The size and shape of an atomic force microscope (AFM) tip strongly influence the resolution and accuracy of the instrument. Here we present a new means to directly measure tip wear *in situ* during contact-mode AFM scanning. Tip wear is observed from changes in contact radius determined by contact resonance force microscopy (CR-FM). In CR-FM, a flexural eigenmode of the cantilever is excited and tracked while the tip is in contact with a sample. As the tip wears, the resonant frequency increases, corresponding to increased contact radius. We demonstrate excellent agreement between quantitative tip wear results from CR-FM and from established *ex-situ* techniques such as scanning electron microscope imaging. Even for compliant cantilevers scanned at very low forces, we are able to resolve subnanometer changes in contact radius. Overall, benefits of our wear-monitoring approach are that CR-FM provides quantitative values of contact radius, allows continuous measurements, affords high spatial resolution, and does not adversely influence the wear rate.

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