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Using X-ray Vision to Understand How Things Break: Coherent X-ray Diffraction Imaging of Materials In Extreme Conditions[1]

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Two recent advances are radically changing the way we study materials. First, revolutions in x-ray sources are providing thousands to millions of times brighter x-ray beams. These sources (i.e. upgraded synchrotron storage rings and x-ray free electron lasers) are enabling scientists to probe materials at ever faster temporal and spatial length scales. Second, rapidly advancing coherent x-ray imaging techniques are taking advantage of these increases to perform nanometer scale and ultrafast imaging of materials. Furthermore, the possibility of improvement in the majority of our current technological capabilities is limited by material properties. There is a need to understand how materials behave under extreme conditions and how they ultimately fail across many industries and applications in order to improve current materials. In this talk, I will review how we are taking advantage of these revolutions to study material failure using a lensless imaging technique known as 'x-ray coherent diffraction imaging.' I will introduce the principles of x-ray coherent diffraction imaging and describe several applications to study metal damage and failure under extreme conditions.

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