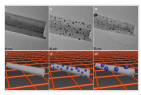
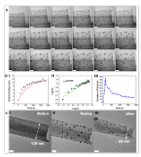
Figures and tables





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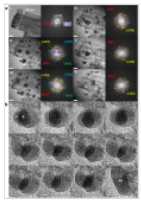

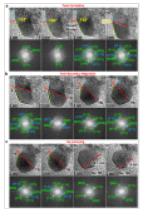

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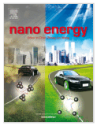

s and defect evolution of single-crystal anoparticles

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process to synthesize and deform piezoelectric nanocrystals

efects within piezoelectric nanocrystals with high spatial
tu TEM.
ating types and evolution process of defects within piezoelectric
r deformation.
tanding in defect behaviors and deformation mechanisms of
crystals.
ipulating piezoelectric performance and mechanical reliability of
crystals.

Piezoelectric nanocrystals have been widely used for self-powered nanosystems, implantable biodevices, wireless sensors and portable/wearable electronics. These nanocrystals function by transforming mechanical deformation into electricity for energy harvesting. Defects are inevitably generated during such mechanical deformations, and these defects are essential for the overall piezoelectric performance or mechanical reliability of piezoelectric nanocrystals. However, defects inside piezoelectric nanocrystals during deformation are rarely investigated, due to the difficulty to obtain direct experimental information. Here, we synthesize and deform piezoelectric nanocrystals sequentially in TEM column to enable in-situ high spatial-resolution study of defects within these nanocrystals. Planar defects form and evolve due to the internal strain caused by piezoelectricity of nanocrystals. The elimination of these defects are also directly observed due to annealing effect of electron beam irradiation. Throughout the whole deformation processes of nanocrystals, planar defects are found to be the dominating defect type. The present technique can also be applied for studying deformation mechanisms of other piezoelectric nanocrystals, as a complementary approach to nanoindentation TEM holder. The obtained insights here in defects evolution and deformation mechanisms of piezoelectric nanocrystals would be beneficial for controlling their piezoelectric performances and mechanical reliabilities.

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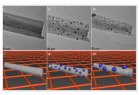

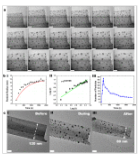

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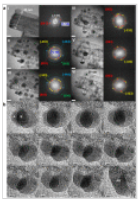

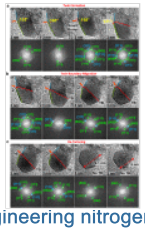

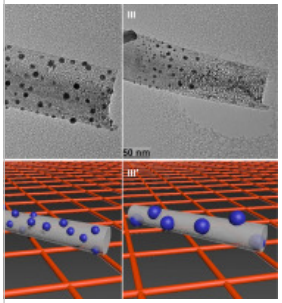

es; Piezoelectric constant; Energy scavenging; In-situ TEM;

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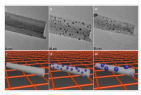

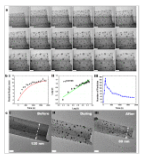

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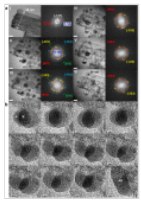

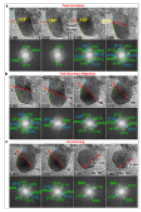

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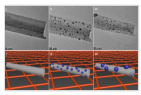

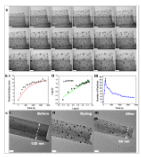

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