# Kinetic Optimisation of Zinc Oxide Nanowire Growth For Piezoelectric Nanogenerator Applications Through A Sol-Gel Process

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One-dimensional Zinc Oxide Nanowires (ZnO NWs) have attracted a lot of attention due to their remarkable physical and chemical properties for electronic and optical devices, like chemical sensors, field effect transistors, and nanogenerators.

Piezoelectric materials, for instance zinc oxide, exhibit an induced voltage under applied stress. This piezoelectric property has interesting applications in energy harvesting systems, like autonomous micro-devices.

Compared to the vapour phase synthesis method, a sol-gel process for growing ZnO NWs has many advantages, such as low cost, low processing temperature, and scalability. Furthermore it opens up the possibility to use a wide range of substrates. Therefore a sol-gel process was implemented to grow well-ordered ZnO NWs.

The objective was to obtain vertically well-aligned ZnO NWs by controlling the growth rate, shape, and density. The shape and density parameters are correlated and dependent on the concentration of the main reagents: zinc salt, ammonia, and ethanolamine. Recent work in this field has shown that adding a seed layer strongly influences the crystallinity and the growth of the nanowires.

The kinetic parameters of temperature and pH were controlled and monitored to develop a scalable, reproducible, and repeatable process. An original seed method was used in order to orientate the growth of ZnO crystals and to control the growth speed.

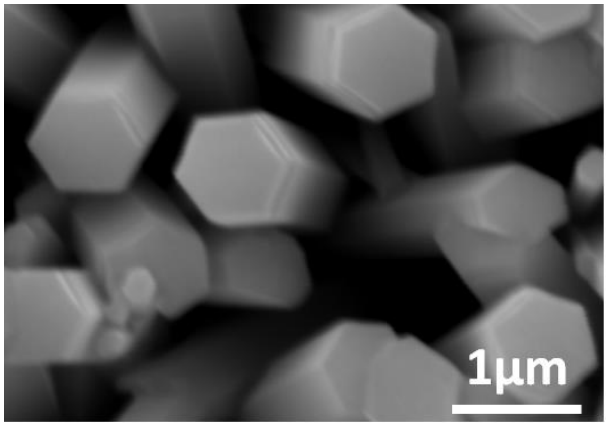


Figure 1. Top view SEM image of ZnO nanowires grown using seeding method

**Keyword(s)**

ZnO nanowire-ZnO seed layer-crystal growth-piezoelectric materials-nanogenerators