

## Sensing Mechanism of Nano-Toxic Ions Using Quartz Crystal Microbalance

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**Abstract :** Detection technique of nanotoxic materials is strongly imperative, because nano-toxic materials can harmfully influence human health and environment as their engineering applications are growing rapidly in recent years. In present work, we report the DNA immobilized quartz crystal microbalance (QCM) based sensor for detection of nano-toxic materials such as silver ions, Hg<sup>2+</sup> etc. by using functionalization of quartz crystal with a target-specific DNA. Since the mass of a target material is comparable to that of an atom, the mass change caused by target binding to DNA on the quartz crystal is so small that it is practically difficult to detect the ions at low concentrations. In our study, we have demonstrated fast and in situ detection of nanotoxic materials using quartz crystal microbalance. We report the label-free and highly sensitive detection of silver ion for present case, which is a typical nano-toxic material by using QCM and silver-specific DNA. The detection is based on the measurement of frequency shift of Quartz crystal from constitution of the cytosine-Ag<sup>+</sup>-cytosine binding. It is shown that the silver-specific DNA measured frequency shift by QCM enables the capturing of silver ions below 100pM. The results suggest that DNA-based detection opens a new avenue for the development of a practical water-testing sensor.

**Keywords :** nano-toxic ions, quartz crystal microbalance, frequency shift, target-specific DNA

**Conference Title :** ICGCE 2017 : International Conference on Green Chemistry and Environment

**Conference Location :** Stockholm, Sweden

**Conference Dates :** July 13-14, 2017