

## Abstract

In the current thesis, chemical reactions of atomic clusters of gold has been pursued with chemical species, leading to changes in the optical properties of the former. Further, chemical interactions based identification of molecules, with precision up to “a few particle level” could be achieved using gold nanoclusters. This thesis is divided into 6 chapters.

**Chapter 1** introduces a brief idea about atomically precise clusters – their synthesis and their application potential.

**Chapter 2** reports chromaticity coordinate based discrimination of biothiols using chemically interactive dual emitting nanoprobe at a few particle level.

**Chapter 3** reports crystallization induced emission enhancement of nanoclusters mediated via zinc ions and one-step conversion of nano-cluster to nanoparticles via sulphide ions. This formed the basis for intercellular logic operations.

**Chapter 4** reports visible light excitation induced luminescence from gold nanocluster upon interaction with  $Zn^{2+}$  for cellular imaging and daylight sensing of analytes.

**Chapter 5** reports modulation of the luminescence of atomic clusters via ligand exchange reaction mediated post synthetic modification.

**Chapter 6** provides concluding remarks and discusses the various futuristic prospects of the current thesis.