Optical Read Out of Nanoparticle Fluorescence Using Supercontinuum Generation for Optical Data Storage

B. J. Chick[1], J.W. M. Chon[1], R. Evans[1, 2], M. Gu[1]
1. Centre for Micro-photonics, Faculty of Engineering and Industrial Sciences, Swinburne University of Technology, Hawthorn, Australia.
2. CSIRO Molecular and Health Technologies, Clayton Victoria Australia.

Nanoparticles have been recently studied for optical data storage because of their unique characteristics such as enhanced fluorescence signal and size control. Data storage techniques have shown the use of nanoparticles can increase the density of optical data by spectral encoding [1]. In this article, we report on the use of spectral features of a photonic crystal fiber generated supercontinuum in the optical read out of nanoparticle fluorescence.

Supercontinuum generation has a particular advantage over conventional white light sources because the output spectrum is pulsed, [2] allowing for readout based on nonlinear processes such as two-photon absorption. Such readout is of particular interest in optical data storage, since data recording can be multidimensional. The aim of the research completed in this article is to develop a system for the readout of the multi-nanoparticle fluorescence.

Three nanoparticles, in this case colloidal semiconductor quantum dots, were synthesized to produce particles with different fluorescence spectra. The quantum dots were then randomly dispersed into a polymer matrix. A nonlinear optical fiber (PM-NL-750 Crystal Fiber) was pumped using a titanium sapphire laser (Tsunami SpectraPhysics) to produce a supercontinuum with a bandwidth that covered to quantum dot excitation region. Spectral features of the continuum bandwidth were selected for excitation of the quantum dot sample using a grating and a spatial light modulator as shown in figure 1. We have observed that three color fluorescence signals can be measured by the excitation by supercontinuum, which is important to the development of spectrally encoded data storage.

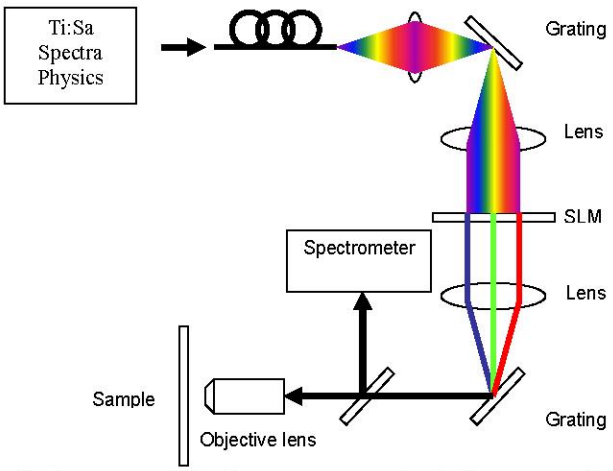

Fig. 1 The optical arrange of the fluorescence readout of a nanoparticle doped polymer

References

1. . J. W. M. Chon , C. Bullen, P. Zijlstra and M. Gu, " Spectrum encoding on gold nanorods doped in silica sol-gel matrix and its application to high density optical data storage," **Adv. Func. Mater.**,in-press (2007)
2. W. H. Reeves *et al.* "Transformation and control of ultra-short pulses in dispersion-engineered photonic crystal fibers" **Nature 424** 511-515(2003).