Abstract

Few studies have been reported on the integration of the 2D material on silica toroid cavity. This is because the cavity shape is curved thus being difficult to transfer monolayer onto the surface. The goal of this study is to understanding the interaction between the toroid cavity and MoS2 monolayer by transferring the monolayer to the fiber tip and placing it close to the cavity. The optimum structure of the cavity is obtained with FEM. This experiment revealed that the insertion of a buffer graphene layer between MoS2 and silica substrate (material with which we will fabricate the microcavity structure) will successfully enhance the emission and will enable us to perform cavity QED experiments.

Background

MoS2 evolves from an indirect bandgap to a direct bandgap semiconductor when thinned to a monolayer.

Monolayer is transferred to the 2D photonic crystal. Spontaneous emission rate is enhanced by Purcell effect.

Monolayer is integrated with high-Q WGM silica disk cavity. By using taper fiber, monolayer is effectively excited.

Influence of the substrates

1. Transferring monolayer to the substrate

2. Monolayer PL intensity on various substrates

Future plan

1. Determination of the best substrate

Other TMDs

h-BN

Graphene

or Sandwich structure...

2. Integration of the MoS2 with silica toroid or photonic cavity

- PL enhancement due to Purcell effect

- Nonlinear effect by strong intra-cavity power

Optical fiber

monolayer

nanobeam cavity