Application of optical properties of diatoms

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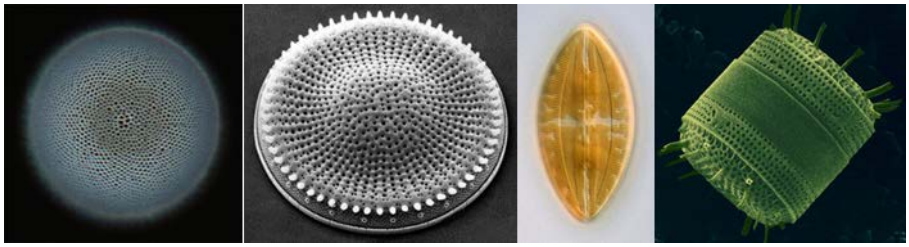
INTRODUCTION

Optimizing the use of the world's limited resources is one of the biggest challenges facing decision making today, challenging research into finding new materials and ways of applying every part of a resource in an energy-efficient way. Diatoms are a globally dominant group of algae representing a staggering 20-25% of the world's net primary production but are still a virtually unexploited resource. Diatoms present a promising production system for not only organic biomass and bio fuels. They are unique in their potential as production systems of inorganic biomass as their intricate silica walls have repetitive nanostructures with special optical properties with potential for a broad range of photonic, industrial applications.

THEORY

The nanostructured silica wall or frustule of diatoms is unique for each species, where a few examples are shown in the figure.



As diatoms grow by photosynthesis they are an efficient light harvesting organism in which the frustule plays a crucial role. In our experiments we have demonstrated that a centric symmetric diatom can generate multiple focus points of visible light caused by diffraction of light by the sub-micron sized holes in the frustule. Light in the UV spectral region can potential damage the diatom so we have looked into if the frustule has a "built-in" UV protection. To do this we have made both local and large area observation of the wavelength dependent diffraction of the frustule from the UV to the near infra-red spectral region.

Discussion

We demonstrate transmission measurements performed on centric symmetric species of diatoms. We show the formation of multiple focus points as well as local and large area spectroscopy of light transmission through the frustule. Furthermore we discuss the observed optical effects for potential application use.