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### The optical properties of dichroic doped NCS glasses

The Lycurgus cup, a remarkable example of a late roman glass, is famous for its dichroism, that is, the ability to change color depending on the direction of light. It is cut from a piece of NCS glass, containing small amounts of iron, calcium, phosphorus, silver and gold. After striking the glass is semi-opaque, being red in transmitted light and green in reflected light. The optical properties of the glass are usually explained by light absorption and scattering by bimetallic AgAu nanoparticles. In this work, we show that AgAu nanoparticles play an important role only in the red color generation due to the absorption of green light. We have synthesized dichroic samples and have found that the green color in reflected light is due to the light scattering on droplets of silica-phosphate glass containing cristobalite crystallites in combination with the absorption of  $\text{Fe}^{3+}$ . For the droplets formation process both iron oxide and calcium phosphate as doping agents are important. The role of iron, that is present in glass predominantly in the ferric form, is very important as it not only gives the green color to the glass, but also causes the phase separation. The change of iron to manganese doesn't provoke phase separation and the glass obtained remains transparent after striking and has reddish violet color in both transmitted and reflected light. The glass prepared without calcium phosphate also remains clear. Thus, the dichroic properties are due to both AgAu nanoparticles and to calcium phosphate and iron content.

### Biography

Sergey Klimonsky has completed his PhD from Lomonosov Moscow State University in 1990. He is the Associate Professor of Faculty of Materials Science. He has published more than 50 papers in reputed journals. In recent years he has worked in the field of physics and chemistry of photonic crystals and other optical materials..

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