

Controlling the Glow of a Heated Metal Film

David J. Norris

Department of Mechanical and Process Engineering

Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

When materials are heated that are structured on an optical length scale, their thermal emission can be modified. This has been explored as a possible route to eliminate unwanted heat from thermal emission sources, such as the filament in a conventional light bulb. In addition, this effect may lead to efficient thermophotovoltaic devices, which convert heat (from the sun or another source) into electricity. Here, we will discuss recent results on the thermal emission of periodically structured metals. In particular, we examine simple metallic films with surfaces that are patterned with a series of circular concentric grooves (a bull's eye pattern). Due to thermal excitation of surface plasmons, a single beam of light can be emitted from these films in the normal direction that is amazingly narrow, both in terms of its spectrum and its angular divergence. Thus, metallic films can generate highly directional beams of light by a simple thermal process. Finally, we will discuss a general and simple route to fabricate such films.