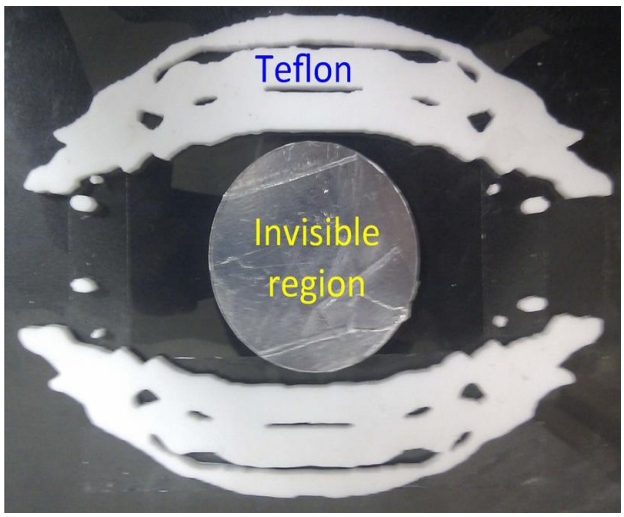
Photonics: Creating an invisibility cloak using Teflon
Using topology optimization as a new way to design invisibility cloaks

The team comprising Prof Ong Chong Kim, from NUS together with researchers from the Zhejiang University in China and the Royal Institute of Technology in Sweden had experimentally demonstrated an invisibility cloak designed using topology optimisation. The advantage of the topology optimization designed cloak is manufacturability. It is carved out of Teflon and it took just 15 minutes using a computer-controlled engraving machine.



The white "eyelid" shaped cloak is made of Teflon and it is able to hide an aluminum disk about the size of a poker chip.
[Image source: Applied Physics Letters]

Attempts in the past to create such cloaks have been via metamaterials, created by assembling a repeating pattern of structures that interact with the light they will cloak. However, the process involved and the materials are expensive and time-consuming, and impossible to manufacture in many cases, and they frequently result in reduced invisibility cloaks which have defects.

Prof Ong and his collaborators took a different approach. Rather than using exotic theoretical light-bending mathematics and physics to develop a cloak, they restricted the material properties to common natural materials. By using a computer model, they aim to find a suitable cloaking structure to steer the electromagnetic fields around an object in a way such that the object itself remains hidden.

They experimentally implemented this idea and fabricated a cloak with a relative large invisible region made of Telflon based on the computer simulation results obtained by a Japanese group published in **Applied Physics Letters**. Telflon is a common commercially available material with permittivity=2 and is widely used in electrical insulation. Good cloaking performance was verified through measurement with the facilities developed by the researchers themselves (the customized measurement facilities were published previously in Review of Scientific Instruments in 2008). Their demonstration had made cloaking more promising for practical applications.

The outcome of the research has been published in **Applied Physics Letters** and featured in **MIT Technology Review**. The researchers are looking to improve the technique to create cloaks that work over a wider range of frequencies and omnidirectional by building more efficient and accurate computer models. If the computer model can yield good performance cloaks that can be manufactured cheaply, soon we may find invisibility cloaks for our everyday objects.