

Visible & IR Beam Combiners

In applications in which an assortment of Visible and IR lasers needs to be co-linearly combined, or a signal of IR and Visible information needs to be resolved, a beam combiner is required.

Due to the limited selection and high cost of materials transparent in the IR, it is advisable to reflect the IR and transmit the visible light. For this there are two potential approaches. The first is to use a metal with optical constants that increase in reflection as wavelength increases. The second is to take advantage of the Transparent Conductive Oxides (“TCOs”) that behave like metal, especially regarding their reflectivity at longer wavelengths.

The determining factor is the balance between the signal intensity and efficiency of the several bands of energy. The metals of Gold and Silver have very high reflectivity in the Far IR but are limited in the visible transmission. Conversely, the Transparent Conductive Oxides (“TCOs”) have good visible transmission but only moderately efficient IR reflectivity.

Chart 1 (FTIR reflectivity) and Chart 2 (Visible Transmission) are overlays of several options:

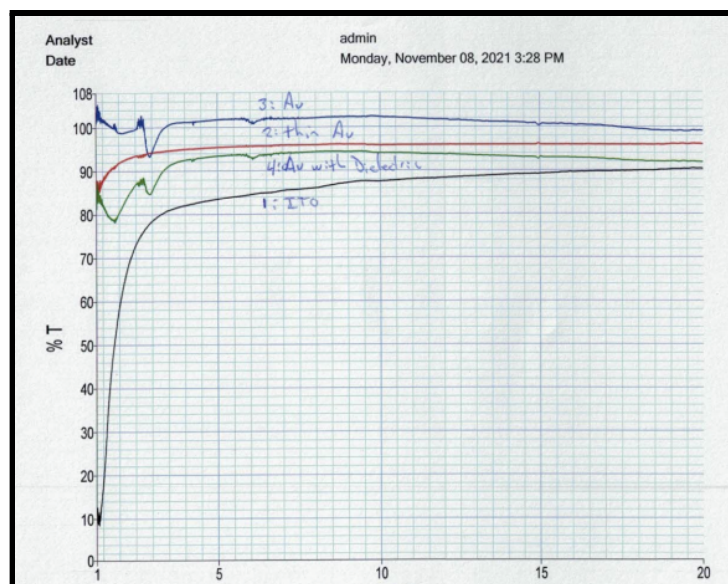


Chart 1

The highest efficiency IR reflector is a thick gold (“Au”) layer with a binder and protective overcoat. The example shown exceeds the performance of the reference mirror in this representation. Possibly the compromise is a thin protected Au with 95% reflectivity at 10.6 microns, and 75% transmission in the visible. The highest visible performance comes from the Indium Tin Oxide (“ITO”), which has visible transmission of over 80%, but only 88% reflectivity at 10.6 microns.

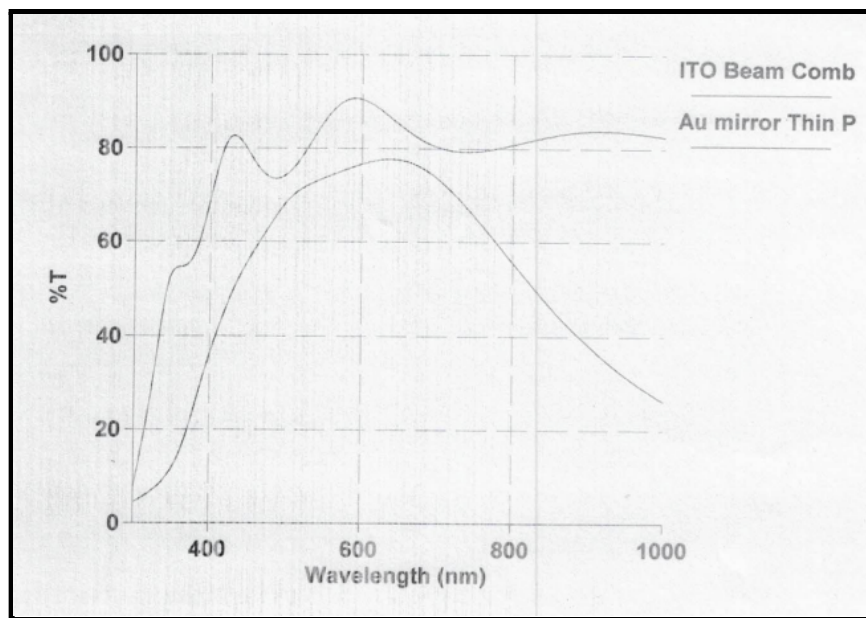


Chart 2

Ultimately, the decision should be made as a tradeoff of desired performance at the various wavelength bands in question.