Introduction

A FLIR\textsuperscript{7} is a thermal imaging system which conducts noncontact thermal measurements and analysis of surroundings. These systems detect and track airborne targets via thermal sensing abilities. FLIRs are commonly used in smart weapons.

Traditional countermeasures are dropped from airborne vehicles targeted by these smart, heat-seeking weapons and consist of a flammable material which is burned at high temperature in an attempt to avoid the missile; however, carrying large amounts of flammable material in an aircraft poses a danger to both the crew and to passengers.

Therefore, we seek to design aperiodic multilayer structures capable of acting as countermeasures which are composed of materials which are not flammable. Such structures would possess broadband emittance in the mid-infrared wavelength range and act as a safe alternative to traditional flares.

Methods and Approach

The Transfer Matrix Method\textsuperscript{6}:

The transfer matrix method calculates the reflectance, absorbance, transmittance of the structures for both the transverse magnetic and transverse electric polarized light. We use data for the real and imaginary parts of each material’s index of refraction.

Micro-Genetic Algorithm:

A genetic optimization algorithm is an iterative procedure in which a random population is chosen and judged by a fitness criterion. The best member of the population is chosen and the optimization procedure continues until an optimum result is reached.

Results and Conclusions

Results:

The tungsten and hafnium structure exhibits peak broadband emittance from approximately 3500 to 4800 nanometers (nm) and 0 to 80 degrees. The tungsten and silicon carbide structure possesses peak broadband emittance from approximately 3200 to 4800 nm and 0 to 75 degrees.

Conclusions:

The field plots of both structures indicate the high lossy properties of the tungsten material with absorbance values ranging from 43 to 55 percent. We find, however, that the tungsten and silicon carbide structure displays the largest broadband emittance in the infrared range.

Future Research

Continue optimization in the infrared spectrum for the purpose of finding better broadband emitting structures.

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