

A Study for Design of Radar Absorbent Material with Broadband Characteristics

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Recently, radar absorbent material (RAM) is used in many cases for the purpose of preventing interference between devices using radio waves. RAM has excellent characteristics such as broadband characteristics, oblique incidence characteristics, and dual polarization characteristics according to use applications. In this paper, we study the design of RAM with broadband characteristics using Genetic Algorithm (GA). The shape of RAM is a two-flat-layer structure so that it is possible to be easily manufactured and to be expanded for use applications. In designing two flat layers RAM with broadband characteristics, it is necessary to optimize calculation of electrical material constants. In this study, 20 dB corresponding to the absorption rate of 99 % is used as an indicator for the radio wave absorbing amount, that is, RCS reduction. In addition, for broadband characteristics, we aim to expand the frequency bandwidth where RCS reduction is over 20 dB. At this time, the purpose is to obtain broadband characteristics within the frequency range which we set to calculate. However, it is important to lower the minimum frequency, that is, the first frequency at which RCS reduction is 20 dB or more. Therefore, the objective functions are set to broadband characteristics and to lower minimum frequency, and the two objective functions are optimized. The design variables are the complex dielectric constant (real part of permittivity and imaginary part of permittivity) and thickness of the intermediate RAM and the surface RAM. When optimizing the design variables of the two flat layers RAM, frequency dependency is considered for the complex dielectric constant. Figure 1 shows the frequency characteristics of two flat layers RAM that meets the two objective functions best. The results are obtained when the upper limit thickness is 10 mm, 20 mm and 30 mm. As a result, the relative bandwidths are 135 %, 158 % and 166 %, respectively. Moreover, the low frequency band is also taken into consideration by optimizing the two objective functions simultaneously. Therefore, RCS reduction characteristics are possible to be obtained in a wider frequency range.

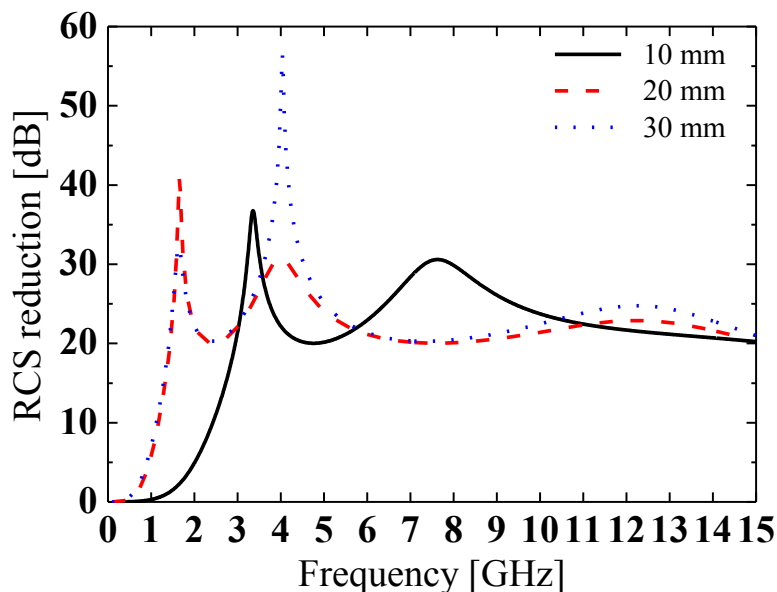


Figure 1. Frequency characteristics of two flat layers RAM.