United States Patent

Grimes

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[54] FERRITE RADAR ABSORBING MATERIAL

[72] Inventor: **Dale M. Grimes,** Ann Arbor, Mich.

[73] Assignee: **The United States of America as represented by the Secretary of the Air Force**

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[52] **U.S. Cl.** .....**343/18 A**

[51] **Int. Cl.** **H01q 17/00**

[58] **Field of Search** .....343/18 A

[56] **References Cited**

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Primary Examiner—T. H. Tubbesing

Attorney—Harry A. Herbert, Jr. and William J. O'Brien

[57] **ABSTRACT**

A means for minimizing the reflections of electromagnetic radiations from metal surfaces in which the reflective metal surfaces is provided with a thin layer of a lithium-cadmium-ferrite material. The ferrite material acts as a protective shield by absorbing incident microwave radiations which are normally reflected from metal surfaces.

1 Claim, No Drawings

FERRITE RADAR ABSORBING MATERIAL

This invention relates to a method for absorbing impinging electromagnetic radiation upon metal surfaces. More particularly, this invention relates to a thin layer of ferrite material in combination with a normally reflecting surface for minimizing the reflection of radio microwave radiation impinging upon metal surfaces which normally reflect such radiation.

The protection of good reflectors from incident radio microwave radiation is well known. Heretofore, protection was provided by affixing a high loss dielectric layer either directly to the surface to be protected or by coating a metallic sheet which in turn provided the necessary protection. However, the protective layers of the prior art were relatively thick and cumbersome while the coated metal sheets had to be positioned away from the surface to be protected. The cumbersome thickness of the protective layers and the undesirable positioning of the coated sheets minimized the amount of protection which could be provided for external applications. This posed a problem of some difficulty since the provision of a radar reflective shield on the exterior of a flying object decreases its radar cross section, thereby improving its overall operability and effectiveness.

In accordance with this invention, however, it has been found that a very thin shield can be provided over a normally reflective surface to absorb impinging radio microwave radiations by utilizing a lithium-cadmium-ferrite as the shield material.

Accordingly, it is the primary object of this invention to provide a means for minimizing the reflection of radio microwave radiations from surfaces which normally reflect such radiations.

Another object of this invention is to provide a radio microwave radiation absorbent layer of a ferrite material.

Other objects and advantages of this invention will become apparent upon consideration of the following detailed description thereof.

In general ferrites are cubic crystalline materials characterized by a spinel structure containing Fe_2O_3 and at least one other oxide, usually of a bivalent metal. Lithium oxide, cadmium oxide, nickel oxide, iron oxide and zinc oxide are all well known ferrite constituents. Ferrite materials have wide technical application and are especially useful in multicoordinate memory devices for use in the computing field.

Heretofore, however, the use of ferrite materials as a protective medium for electromagnetic radiation reflecting surfaces was not known. With the present invention, however, it has been found that very thin layers of ferro-spinel bodies affixed to metal surfaces can provide a high degree of protection by absorbing the incident microwave radiations which are normally reflected from metal surfaces.

For most purposes the ternary diagram yielding solid solutions of $Li_{0.5}Fe_{2.5}O_4$–Fe_3O_4–$CdFe_2O_4$ has provided optimum results. The exact composition depends upon operating temperature and whether narrow or wide frequency range is desired.

The ferrite materials of the invention are singly made, then ground together and poorly mixed. They are then fired to produce a gradient in magnetic properties. The imaginary permeability must be high enough to produce a large loss. For higher frequencies, it has been found that nickel can replace lithium and for narrower bands zinc can replace cadmium. The final ferrite powders are dusted together, pressed and fired at 1,250° C. for 4 hours and slowly cooled. Frequency bandwidth and depth of the minimum depend upon ferrite thickness.

For external applications in accordance with this invention, it has been found that ferrite thickness running from 0.25 to 1.0 cm provide a high degree of protection. The ferrite is backed by a metallic conductor but it could absorb the energy without a backing provided it were of a greater thickness.

While a particular embodiment of this invention has been disclosed and described, it is to be understood that various changes and modifications may be made therein without departing from the spirit and scope thereof as set forth in the appended claims.

I claim:

1. In combination with a normally reflective surface a layer for minimizing the reflections of radio microwave radiation which normally impinge upon said surface said layer comprising a solid solution of $Li_{0.5}Fe_{2.5}O_4$–Fe_3O_4–$CdFe_2O_4$ material.

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