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薄膜型金属网栅的电磁屏蔽特性

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Electromagnetic shielding properties of metallic mesh coatings

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摘要 为寻求准确评估薄膜型金属网栅电磁屏蔽效能的方法,探索了薄膜型金属网栅在某频段可达到的电磁屏蔽效能。首先,分析了金属网栅膜光电特性常用的计算公式,指出电特性公式中材料无限导电的假定条件与客观事实不符,故其无法准确预估薄膜型金属网栅的电磁屏蔽效能。然后,根据屏蔽效能受感应电压和电阻比控制的理论,借鉴连续导电膜用方块电阻计算屏蔽效能的方法,提出了预估薄膜型金属网栅屏蔽效能的方法并给出了具体步骤。最后,采用激光直写工艺流程制备了薄膜型金属网栅,验证了理论计算结果与实验检测结果的一致性。检测结果显示:薄膜型金属网栅试片在30~1 500 MHz的屏蔽效能最高为30 dB;用检测方块电阻并代入连续膜经验公式计算得到的屏蔽效能为31.2 dB,用金属网栅膜常用公式计算得到的屏蔽效能为75 dB。数据显示用金属网栅膜常用电特性公式无法准确评估薄膜型金属网栅的电磁屏蔽效能,而本文所提方法便捷、准确、可行。

关键词 : 透明导电膜, 金属网栅, 电磁屏蔽, 方块电阻

Abstract : To find a suitable method for evaluating electromagnetic shielding properties of metallic mesh coatings, the shielding effectiveness of a general metallic mesh coating was explored. Firstly, a set of the formulas commonly used to calculate the photoelectric characteristics of metallic mesh was analyzed. It points out that the infinite conductive material assumption of formulas is not reasonable, and these formulas can not accurately forecast the electromagnetic shielding effectiveness of thin-film metallic mesh. Then, according to the theory that the shielding effectiveness is associated with the ratio of induction voltage to resistance, a method to estimate the shielding effectiveness of thin-film metallic mesh was proposed by using the shielding effectiveness calculation formula of the continuous conductive film with the square resistance, and the estimation concrete steps were given. Finally, three specimens of thin-film metallic meshes were prepared by the laser direct writing process to test the validity of the method. The results for 30 MHz to 1 500 MHz band show that the highest electromagnetic shielding efficiency of specimens is 30 dB by the coaxial test method, and the calculation value is 31.2 dB by using the method proposed in this paper, as the calculation value is 75 dB by commonly used method. These data indicate that the commonly used electrical characteristic calculation formula of metallic mesh can not accurately evaluate the electromagnetic shielding effectiveness of thin-film metallic mesh, and the method proposed in paper is convenient, accurate and feasible.

Key words : transparent conductive coating metallic mesh electromagnetic shielding square resistance

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