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Contents

Original Article

Perfect electromagnetic and sound absorption via subwavelength holes array 180013

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The absorption or dissipation of the energy carried by waves is of great importance in many applications ranging from energy harvest and information exchange to radar wave and sound noise control. Among the various types of waves, the electromagnetic and acoustic waves share many similarities. The two disciplines have borrowed concepts from each other to grow up alternately. For example, the time-reversed sub-diffraction focusing technique was first developed by the acousticians and then utilized in the optical domain to break the diffraction limit. On the other hand, the hyperlens was originally created in the optical domain and then introduced to acoustic research. Recently, the concept of metasurface, an artificially structured thin film with property on demand, has become a hot spot in both the electromagnetic and acoustic regimes. It is, however, surprising that many metasurface concepts such as Salisbury and Jaumann absorbers in the electromagnetic design have not been extended into the acoustic domain. Although ultrathin and ultra-broadband electromagnetic absorbers have been realized, similar thin absorbers are still difficult to obtain for acousticians. In this paper, we theoretically compared the boundary conditions for electromagnetic and acoustic metasurfaces. Similar to electromagnetic metasurface absorber, we show that various acoustic absorbers can be achieved using the effective impedance of deep-subwavelength perforated rigid plate. In particular, an ultra-broadband and thin acoustic perfect absorber is demonstrated under coherent condition, showing excellent performance comparable to its electromagnetic counterpart.

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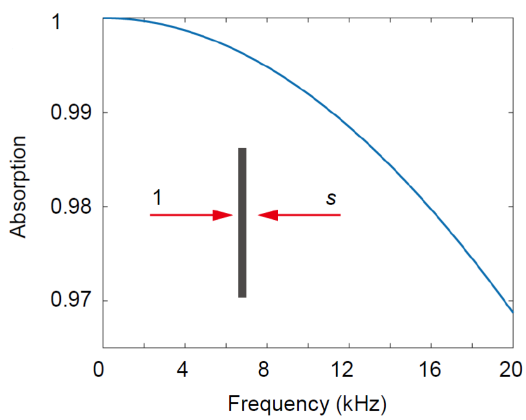

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Original Article

Enhancement of laser ablation via interacting spatial double-pulse effect 180014

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Short pulsed laser has been employed as an effective tool for micromaching. Versatile methods are offered for cutting, drilling and modification of various engineering materials. However, traditional laser processing has been unable to meet the needs of industry. A novel spatial double-pulse laser ablation scheme is investigated to enhance the processing quality and efficiency for nanosecond laser ablation of silicon substrate. During the double-pulse laser ablation, two splitted laser beams simultaneously irradiate on silicon surface at a tunable gap. The ablation quality and efficiency are evaluated by both scanning electron microscope and laser scanning confocal microscope. As tuning the gap distance, the ablation can be significantly enhanced if the spatial interaction between the two splitted laser pulses is optimized. The underlying physical mechanism for the interacting spatial double-pulse enhancement effect is attributed to the redistribution of the integrated energy field, corresponding to the temperature field. Experimental analysis shows that the ablation efficiency could be enhanced by 65% with better quality of micromaching by the interacting spatial double-pulse enhancement effect. This new method has great potential applications in laser micromachining of functional devices at higher processing quality and faster speed.

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