Pioneering Metamaterial Geometric Design: Advancing Novel Applications in Engineering

Sheng-hung Weng
Department of Mechanical Engineering, National Hsinchu Industrial High school, Taiwan

Sheng-Chiuan Weng
Department of Mechanical Engineering, National Taiwan University of Science and Technology, Taiwan

Chia-Chi Chang
Micro-Polymer laboratory, Jau-Nan Junior High School, Taiwan

Pei-Tzu Weng
Micro-Polymer laboratory, Jau-Nan Junior High School, Taiwan
Department of Mechanical Engineering, National Hsinchu Industrial High school, Taiwan

Abstract:

This study is dedicated to developing an innovative Composite Material Hardness Test (CHT) method for evaluating the hardness of composite materials. The system is expected to combine metamaterials with negative Poisson's ratio characteristics and different arrays of indenter to design the Composite Material Hardness Test (CHT) system. Several hardness testing indenter arrays are arranged beneath the metamaterial geometric structure, and a pressure is applied to create indentations on the test specimen. Using ImageJ software, the system analyzes the projected indentation area, relative positions, and displacement directions of the indentations. This enables obtaining several hardness value data of the material simultaneously, and the hardness changes of local areas of the material are also analyzed. By controlling environmental parameters, negative Poisson's ratio structure parameters, and other parameter conditions, the Composite Material Hardness Test (CHT) method can adjust the testing system to be suitable for testing composite materials with different hardness ranges. This study investigates the principles of hardness testing, the research results are expected to provide new possibilities for scientific research and academic development.

Keywords:

Hardness Testing, Negative Poisson's Ratio, Metamaterials, Polymer.