

Abstract

The paper presents research on the effectiveness of electromagnetic field shielding and thermomechanical properties of composites manufactured by pressing. Particular emphasis was placed on examining the parameters that determine electromagnetic field shielding.

In the first stage of preliminary research, composites were produced for testing volume and surface resistance as well as magnetic permeability. The following fillers were used to produce the composites: aluminium scrap dust from the machining, brass after machining, mill scale, nanocrystalline tapes and polymers: HDPE, POM and PVC. By analysing the results of resistance, magnetic permeability and composite stability tests, samples were produced for preliminary screening effectiveness tests. As a result of the preliminary analysis, mill scale and nanocrystalline sheet were used as filler for the main tests, and HDPE polymer was used as the composite matrix. The fillers used for composites were prepared by grinding the material and sieving it into different fractions. The composites were produced by compression pressing in a heated mould.

The composites were made with different percentages of matrix and filler in mass ratio. The manufactured composites were tested for their electromagnetic field shielding effectiveness. After analysing the test results for composites with one type of filler, it was found that the most favourable composite parameters were obtained with 70% filler content - the proportion by mass is 70% filler to matrix.

Based on the analysis of preliminary tests, in order to improve the electromagnetic, mechanical and thermomechanical properties, a composite was produced using two types of fillers and the composition of the composite with the most favourable properties was selected.

As a result of the analysis of the shielding effectiveness, layered and mixed composites were made to verify their mechanical properties and the shielding effectiveness was tested in an anechoic chamber for various frequencies. Based on mechanical tests and electromagnetic field shielding tests, it has been shown that that a mixed composite containing 55% mill scale, 30% HDPE, 15% crushed nanocrystalline sheet is characterised by favourable thermomechanical and electromagnetic field shielding properties.