Disposal of waste rubbers, especially waste tires, which constitute the largest volume of scrap rubber, is a serious environmental problem. Cross-linked rubber formed during vulcanization is extremely resistant to biodegradation and decomposition in chemical or thermal processes. In addition the amount of waste rubber is still growing. That is why recycling of rubber is a great challenge nowadays.

In this work we are going to present morphological analysis, with the usage of optical microscopy (OM) and transmission electron microscopy (TEM), of new group of polyurethane–rubber recyclates composites. They were synthesized (in situ) from cast urethane elastomers and different amount of rubber powders, obtained by cryogenic grinding of waste tires. The polyurethane matrix (PU) of composites materials was prepared from α,ω-dihydroxy[oligo(buthylene-ethylene adipate)], 4,4'-methylene diphenyl diisocyanate and 1,4-butanediol. Granulated rubber wastes (of granularity below 1,25 mm) were added in the amount of 10 to 90 wt.% during the synthesis of PU. The microstructure of obtained composites was studied with the use of optical and electron microscopy. The cross-sections and cryo-fractured surfaces were prepared for microscopic analysis. For the comparison granulated rubber particles were studied as well under microscopes.

It was found that granulated rubber particles, obtained by cryogenic grinding, have smooth surfaces before and after adding to PU matrix. Due to this, rather weak adhesion was observed at the interface of PU matrix and rubber particles added and mechanical properties of these composites were low. For better adhesion of rubber to PU matrix, the modification of rubber surface will be undertaken in the future.

Nevertheless, some composite materials obtained have excellent flexibility, resiliency, weatherability and abrasion resistance, so they can be
used as elastomeric paving materials for footways, playground mats and isolation materials.
