

Electrostatic separation to sort and recycle plastic wastes

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The most polymers are incompatible in their melt or solution. Phase separation processes lead to an unsatisfactory quality of goods made from recycled plastic materials. In order to produce useable consumer goods from plastic waste, the recycling process requires a sorting where the plastic waste is separated into its material fractions. The electrostatic separation of plastic waste is an effective and reasonably priced technology. It bases on the well known electrostatic charging of polymers: Two polymer grains were electrically charged during their collision. After separation the formed charges remain stable. The known tribo-electric rows show that the charging behavior of polymers correlates with their chemical structure. In a tribo-charged mixture of two different polymer species one of the two polymers is positively charged and the other is negatively charged. If they drop in an electrostatic field the oppositely charged polymers were separated into sorted polymer fractions. In actual practice the simple process seems to be more complex. The separation in the electrostatic field requires a high and selective charging of all components in a polymer mixture. However, some of the common polymers, e.g. polyethylene (PE) and polypropylene (PP) do not satisfy this condition. In our work we studied the charging-up and discharging of different polymers to explain the mechanisms of charge formation and the stability of charges on polymer surfaces. A couple of parameters, e.g. the time to charge the polymer grains and the air humidity, have an immense influence on the quality of the separation process. Particularly, the variation of the air humidity seems to be an important tool to control the charging behavior and the separation quality. In order to separate mixtures consisting of polymers having a low tendency to be charged (PE/PP), we applied additional treatments to improve the polymers' charging behavior selectively.