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Elastomer-based Fastener Development to Facilitate Rapid Disassembly for Consumer Products

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Abstract

Increasing resource prices, ever-higher complexity of products, recent developments in legislation and the importance of a green brand image have resulted in an increased interest of original equipment manufacturers to facilitate a disassembly based end-of-life treatment for their products. The main reason is that precious metals, rare earth elements and plastics can be recovered with the highest yield and purity in a disassembly based treatment. However, original equipment manufacturers currently face several issues for the implementation of design for disassembly. To overcome these issues, first of all an in-depth analysis of design-for-disassembly opportunities and challenges is presented. Taking into account the results of this analysis, innovative low-cost elastomer-based fasteners have been developed, which can be simultaneously released by applying a sufficiently high force over a period of time. In addition, an experimental validation method was developed and adopted to demonstrate that the developed fasteners allow reducing the disassembly time by 70% to 90% for the housing of LCD TVs without compromising product robustness. The presented calculations indicate that the implementation of the developed fasteners is profitable from an overall perspective in regions with a labor cost higher than 7 €/h. However, original equipment manufacturers currently lack incentives to adopt design for disassembly for products sold in a Business-to-Consumer market, which are jointly collected and treated at end-of-life. Therefore, a differentiation in recycling fees proportional to the reduction in disassembly time is proposed to provide economic stimuli for original equipment manufacturers to implement these fasteners. Such a differentiation scheme, combined with the presented insights on opportunities to facilitate disassembly processes and the required resistance of fasteners to forces in function of time, will stimulate and enable the development of products which can be disassembled in an economically viable manner, resulting in improved material recovery from end-of-life products in industrialized regions.

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