Advanced Materials Engineering II

April 22 (Mon) 4:50pm–6:35pm

Lecture Room #42, Faculty of Engineering Bldg. 4

The Art of Adhesive Formulation and Debonding Technologies

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Adhesive science is a dynamic interplay of chemistry, physics and technology. In this lecture we will gain insights into the formulation of adhesives. We will discuss the specific chemistry behind different types of adhesives. We will explore how adhesives can be customized for specific requirements. The functionalization of polymers for precise bonding requirements will also be presented. Examples include the modification of hydrophobic polyolefinic hotmelt adhesives to bond hydrophilic substrates such as aluminum and wood. In addition, we will discuss the implementation of different curing and toughness behavior of epoxy-based structural adhesives. Modern analytical methods allow us to better understand the properties of adhesives. The lecture will use concrete examples to show how adhesives can be characterized effectively.

The second part of the lecture deals with new technologies for the disassembly of bonded joints. While adhesives aim for durability, controlled failure is sometimes necessary. On-demand debonding is particularly important for repairs, recycling and in end-of-life scenarios. Thermal decomposition, precise cutting or a combination of these techniques can separate bonded substrates. Alternatively, strong chemicals might dissolve the adhesive. An alternative approach is to use adhesive systems that enable on-demand debonding, where the bond is weakened by an external trigger, allowing for intentional separation. One possibility is the addition of reactive fillers to the adhesive. The best-known fillers here are thermally expanding particles, which will be discussed in this lecture. Other possibilities are electrical debonding or the use of reversible bonds in the adhesive. However, integrating debonding technology into an existing system or process can lead to compatibility issues or alter the rheological and mechanical properties of the adhesive system.

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