Editorial corner – a personal view

(Multi)functional polymers and composites via Diels-Alder reactions

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Nowadays, research activities address the development of (multi)functional (also termed to as intelligent, smart, responsive) materials. The attribute ‘functional’ refers to a combination of properties which are essentially independent of each other. Accordingly, the related materials – apart from the required load bearing capability – exhibit ‘functional’ properties, such as shape memory, self healing, sensing/actuation, electric conductivity, reprocessability etc.

Chemical approaches, and especially those offered by the click chemistry can well be used to produce multifunctional polymers and related composites. In the Diels-Alder (DA) reaction a cyclic compound is formed in the reaction between a diene (usually furan, cyclopentadiene, anthracene) and a dienophile (usually maleimide, methacrylate, dicyclopentadiene). The discovery of this thermoreversible reaction is credited to O. Diels and K. Alder (1924) who have been awarded by the Nobel prize in 1950. A further beauty of the DA reaction is that it can be performed in aqueous media, solutions and melts, as well. DA adducts can be repeatedly generated after retro DA reactions liberating the initial functional groups. This feature has been used to demonstrate the feasibility of intrinsic self healing (DOI: [10.1126/science.1065879](https://doi.org/10.1126/science.1065879)). This pioneering work triggered vivid interest for adapting DA reactions for self healing and recycling (i.e. reprocessing) of highly crosslinked thermosets, especially epoxy resins (DOI: [10.1039/c2py20957h](https://doi.org/10.1039/c2py20957h); DOI: [10.1002/pola.27655](https://doi.org/10.1002/pola.27655)). The most versatile polymer synthesis, namely that of polyure-

thanes, is in the forefront of DA-related research. The furan/maleimide reaction proved to be a straightforward tool to create reprocessable rubbers, the characteristics of which are similar to traditionally crosslinked ones (DOI: [10.1021/acs.macromol.5b01422](https://doi.org/10.1021/acs.macromol.5b01422)). DA reaction is a promising route also to create self healing interphase in polymer composites (DOI: [10.1016/j.compscitech.2015.08.015](https://doi.org/10.1016/j.compscitech.2015.08.015); DOI: [10.1016/j.pmatsci.2015.02.003](https://doi.org/10.1016/j.pmatsci.2015.02.003)). Recent efforts focus on the exploitation of hetero DA reactions in the synthesis of functional polymers (DOI: [10.1039/c4py00644e](https://doi.org/10.1039/c4py00644e)). In the meantime exhaustive reviews appeared on the use of DA reactions to produce multifunctional polymer and related composites. The interested reader will find several contributions also in our Journal when searching for ‘Diels-Alder’ on the web site of *eXPRESS Polymer Letters*, and they will be even more.

On the other hand, the versatility of DA is still less explored at present because most of the publications follow the furan/maleimide reaction pathway (DOI: [10.1016/j.progpolymsci.2012.04.002](https://doi.org/10.1016/j.progpolymsci.2012.04.002)). So, why not to explore further the ‘offer’ of the DA reactions?

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