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Plasma-based activation as a part of multi-step and combined processes for surface functionalization of polymers

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Electrical discharge plasmas are valuable tools for the alteration of surface properties of organic materials such as polymers. The highly energetic species produced in such a discharge can efficiently break bonds even of inert polymers. These activation processes are based on the oxidation of the material's surface. The oxidation chain reactions are rapid and result in a rather broad spectrum of different chemical structures. These functional groups are responsible for the higher surface free energy, the better wetting, and the improved adhesion of the material. For other applications, a more specific and defined chemical structure is required. Then other process gases are used to feed the discharge. In such processes the surface chemical structure of the original material can be modified or a coating with a plasma polymer takes place and a more defined surface chemical structure can be prepared.
In some cases multistep and combined processes can be the most efficient way to produce particular surface properties. Electrical discharge plasmas have been proven to be extremely efficient in the activation of polymer surfaces. The functional groups produced by the plasma can be used to run reactions by adding agents from the gas phase or by liquid phase processes. In this way a very well defined surface chemistry can be produced which is not accessible by plasma-only processes. In such an approach the advantages of plasma chemistry and classic organic chemistry can be combined for the production of high quality products.
In the paper we will show examples how the activation step influences the following reactions and, consequently, the over-all efficiency of the process. The plasma treatment usually is an important part of the process chain. The details of the treatment determine the way the following reactions are carried out and also the rate of these reactions. The plasma treatment has a substantial influence on the final production costs.

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polymer
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