Sintering of PTFE-PEEK polymer blend in air atmosphere

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The poly(tetrafluoroethylene) (PTFE) is a polymer with exceptional self-lubricating properties, a low coefficient of friction (CoF), good chemical resistance, and operating temperature up to 250 °C. Thanks to these properties, PTFE finds a unique position in the industry as a base material for tribological components, for example, journal bearings or piston rings. The pure PTFE has very low abrasion resistance. For this reason, it is commonly filled - typically glass fibers, bronze, MoS_2, or graphite. This can cause problems since the potential release of fillers is not allowed in specific applications or can cause abrasion of the counterpart.

In recent decades, several scientific papers have dealt with a polymer blend based on PTFE and poly(etheterketone) (PEEK). It was found that a suitably prepared mixture may exhibit better wear resistance than individual pure components while maintaining a low CoF, self-lubricating behavior, and high service temperature. Research topics were focused mainly on tribological properties (CoF and wear rate) across the blend composition or in different environments. Although different methods of preparation and sintering temperature programs were used, the literature mentions no or minimum information about the sintering in an air atmosphere.

For industry, where PTFE-based materials are typically prepared by pressing and sintering in the air atmosphere, this knowledge can be essential since a PTFE sintering temperature program causes significant degradation of PEEK. In this work, initial steps to find basic principles of "how to design a suitable sintering temperature program" have been done. Several programs were designed and used. Changes in thermal properties of sintered PTFE-PEEK samples, which related to the degradation, were evaluated by differential scanning calorimetry. Measurements were made from the surface, from the center, and across the cross-section. As a result, a sintering program that causes a minimum degree of degradation was chosen for the following research.