New scientific achievements

1.a, In the surroundings of the contact area, I explored the entire heat generation process in the Pin-on-Disc equipment in order to examine factors affecting wear more reliably. I established that more than 99% of the quantity of heat generated is distributed along the ’disc side’ to ensure identical contact temperatures. In the event of contact by several structural components, it is reasonable to include contact heat resistance in the FE heat model.

1.b, I developed a moving and a distributed heat source model for the circular sliding friction movement investigated. By comparing the results yielded by the moving and distributed heat source models, I established that under the conditions prevailing in the Pin-on-Disc equipment (pv=0,1÷10 MPa·m/s) the moving heat source generated by the sliding friction contact between the standing rod and the rotating disc can be substituted by a ’distributed’ heat source spread evenly, except for a small area surrounding the surface.

2.a, I developed an incremental algorithm of contact/heat generation/creep/wear for polymer-steel sliding components in order to determine the quantity of detached material in the course of the wear process. The algorithm takes temperature effects into consideration besides time-dependent material characteristics.

2.b, I applied the algorithm developed for simulating the wear process in the Pin-on-Disc equipment, on the basis of which I made the following statements:

- In the initial phase of the wear process, on-going measurement of pin length change is not suitable for determining wear depth due to a comparable thermal expansion effect. On the other hand, the model taking the wear depth change, the thermal expansion and the deflection of the pin into account shows proper correspondence with the results measured;
- In case of a PEEK material, the effects of creep cannot be left out of consideration at higher temperatures (in the surroundings of T_g);

3.a, I applied the algorithm developed for contact, heat, and wear tests to a metal-polymer hybrid bearing system. I established that the wear depth increment changes to a considerably greater degree in the initial phase than in the consolidated phase of the wear process. Accordingly, the peak value of contact pressure decreases to less than 20% in an hour, while the size of the contact area multiply increases.

3.b, I developed a transient thermal model to determine heat generation behavior caused by sliding friction in the bearing testing equipment. I determined heat source distribution in states associated with discrete moments of time pertaining to the contact model. I established that heat partition changes in the course of the wear process: the initial 70% share of the ’bearing side’ is reduced to 50%. This is caused by heat transfer directed to the large mass of the ’shaft side’.