Polymers and polymer composites are commonly used as solid lubricants. Polyether-ether-ketone (PEEK) is an engineering thermoplastic with a very good combination of thermal and mechanical properties. Although PEEK presents relatively high friction coefficients during unlubricated sliding, the wear rates are remarkably low. Despite this potential as a good tribological material, the high performance abilities of PEEK have not been entirely realized in practice because PEEK-ferrous metal contacts may fail by scuffing and/or two-three body abrasion for certain tribosystems. The traditional design approach to reinforce PEEK has been to use fibres for strengthening and filler particles for lubrication. In this work three materials were analysed: PEEK, Carbon-Fibre (CF) reinforced PEEK and PTFE+Graphite+CF filled PEEK. A series of different tribo-tests was carried out: i- Reciprocating linear Scuffing test with 7N incremental loading every 10 min up to 910N; ii- Constant load (10 N, 5 hours duration), reciprocating sliding tests assessing friction coefficient and wear rates of both specimen and counter body; iii- Free ball micro-abrasion tests using soft, fine abrasive particles. The wear tracks were analysed using SEM and light interferometry in order to assess the morphology of the wear tracks during scuffing, abrasion and sliding tests. The aim was to identify whether the failure mode in the sliding wear of these PEEK based materials is dominated by scuffing or by abrasive mechanisms. Unfilled PEEK exhibited very low scuffing resistance and a large wear rate during reciprocating sliding wear and abrasion, presenting a clear tendency to fail by abrasion mechanisms. CF-reinforced PEEK also presented very low scuffing resistance but higher sliding and micro abrasive wear resistance. It seemed that the presence of CF enhanced protection against abrasion by minimizing plastic deformation, although flaky debris probably originated from subsurface cracking were observed. The addition of PTFE and Graphite to the CF-reinforced PEEK produced a sharp decrease in friction coefficient, high scuffing and abrasion resistance, with an almost non-measurable wear rate in the reciprocating sliding test. The behaviour observed for PTFE+Graphite+CF filled PEEK suggested the transfer of a protective tribo-layer from the composite to the counter-body and vice-versa.

Keywords: PEEK composites, Scuffing, Abrasion