Experimental study on feasibility of alternative materials for tilting pad thrust bearings operating in start stop regime

M. Wasilczuk[1]*, M. Wodtke[1]

[1] Gdansk University of Technology
Faculty of Mechanical Engineering
Narutowicza St 11/12
80-233 Gdansk, Poland

Keywords: hydrodynamic tilting pad thrust bearing, start-stop regime, PEEK lined bearings, DLC lined bearing.

In hydrodynamic bearings traditional bearing alloys: Babbitts and bronzes are most frequently utilized. Polymer sliding layers are sometimes applied as a valuable alternative. Hard DLC coatings, which are also considered for certain applications may show some advantages, as well. Material selection in full film lubrication regime is of secondary importance, but becomes important in mixed friction conditions, which is crucial for bearings with frequent starts and stops.

An experimental research aimed at studying performance of fluid film bearings in specific operating regime, including transition to mixed friction will be described in the paper. Three bearings with different bearing materials were compared. The tests carried out on three tilting pad bearings of 180 mm outer diameter and different material compositions: steel/bronze, DLC/steel and steel/PEEK. The tests comprised stopping under load and reproduction of the Stribeck curve by decreasing rotational speed to very low values and observing the changes of friction force during transition to mixed friction regime. Analysis of the transition conditions and other results showed clear differences between the tested bearings, illustrating feasibility of less popular material compositions for bearings operating in specific conditions. More specifically, the DLC/steel bearing was demonstrating superior performance, i.e. lower friction, transition to mixed friction occurring at higher load, and more stable performance at start stop regime in comparison to a bearing with bronze/steel interface. Friction coefficient in the transition to mixed friction was slightly higher in a PEEK bearing but the transition occurred at higher bearing load.

*Corresponding author: mwasilcz@pg.edu.pl