Bearing Failure:

A major bearing manufacturer contacted me about a manufacturer's in-plant failure that partially shut down the steel mill. Large roller bearings under high temperatures and stresses were failing. The bearing supplier needed to quickly triage the problem; what to investigate first? These large bearings were reworks from shelf stock. The unmodified bearings had a cylindrical inner bore that acted as a mounting surface. They were "opened up" via machining to a 1:12 tapered inner surface to allow a compressive press fit. Before rework, each bearing had been carburized. Reworking removed most, but not all, of the carburized material, and they were not re-carburized. The chemistry of the mounting surface now transitioned from carburized to uncarburized. Would a large change in temperature seen during operation cause a problem with this bearing by non-uniform expansion? Unquestionably, carbides (Fe_3C) expand due to temperature changes at a different rate than does the alloy matrix (principally Fe). I consulted thermal coefficient of expansion tables for various steel chemistries. I found that as the carbon content *increased* the expansion rate *decreased*. Thus, there would be some non-uniform thermal expansion, as expected. However, for the chemistries and temperatures present, only the most sophisticated measurement technology would be able to detect the distortion induced in the race. This gradient in carbon content across the mounting surface would not be deleterious to the bearing's performance at elevated temperature. With the thermal issue resolved, the manufacturer pursued other aspects of the bearing that could be responsible for diminished life.