14. Bearing materials

14.1 Raceway and rolling element materials

While the contact surfaces of a bearing's raceways and rolling elements are subjected to repeated heavy stress, they still must maintain high precision and rotational accuracy. To accomplish this, the raceways and rolling elements must be made of a material that has high hardness, is resistant to rolling fatigue, is wear resistant, and has good dimensional stability. The most common cause of fatigue cracking in bearings is the inclusion of non-metallic impurities in the steel. By using pure materials low in these non-metallic impurities, the rolling fatigue life of the bearing is lengthened.

In general, steel varieties which can be hardened not just on the surface but also deep hardened by the so –called ″through hardening method″ are used for the raceways and rolling elements of bearings. The hardness of the rings and rolling elements is usually on the order of HRc 58 tp HRc 65. The most widely used and most adaptable materials for rolling bearings are high carbon steels. The most commonly used of the steels, SUJ2, is equivalent to such steels as AISI 52100 (U.S.A.), DIN 100 Cr6 (Germany), and GS 534A 99(U.K.). For bearings with large cross section dimensions, SUJ3 having good hardening properities are used. The chemical composition for SUJ2 and SUJ3 is shown in Table 8-1.

14.2 Cage materials

Bearing cage materials must have the strength to withstand rotational vibrations and shock loads. These materials must also have a low friction coefficient, be light weight, and be able to withstand bearing operation temperatures.

For small and medium sized bearings, pressed cages of cold or hot rolled steel with a low carbon content of approx. 0.1% are used. However, depending on the application, austenitic stainless steel is also used.

For those conditions where fluctuating load and high temperature are applied, some pressed are soft nitrided and their shock resistence are enhanced. Materials for pressed cage are listed in Table 14-2.

Injection molded plastic cages are now widely used: most are made from fiber glass reinforced heat resistant polyimide resin. Plastic cages are light weight, corrosion resistant and have excellent damping and sliding properties. Heat resistant polyimide resins now enable the production of cages that perform well in applications ranging between -40℃ – 120℃. However, they are not recommended for use at temperatures exceeding 120℃.

Table14-1 High carbon chromium bearing steel

記 號	Chemical composition %						
	C	Si	Mn	P	S	Cr	Mo
SUJ 2	0.95~1.10	0.15~0.35	0.50max	0.025max	0.025max	1.30~1.60	—
SUJ 3	0.95~1.10	0.40~0.70	0.90~1.15	0.025max	0.025max	0.90~1.20	—
SUS440C	0.95~1.20	1.00max	1.00max	0.040max	0.030max	16.00~18.00	—
SMX70	0.60~0.75	1.00max	1.00max	—	—	11.50~13.50	—

Table 14-2 Material for pressed cage

Symbol	Chemical composition %						
	C	Si	Mn	P	S	Ni	Cr
SUS304	0.08max	1.00max	2.00max	0.045max	0.03max	8.0~10.5	18.00~20.00
SPCC	0.12max	—	0.50max	0.04max	0.045max	—	—