# Material Varieties and Applications 2

### 4. Copper Alloy Materials

| Class | Material Code | Use Application | Comment | JIS | Flat Bar | Hexagonal Bar | Round Bar | Steel Plate |
|---|---|---|---|---|---|---|---|---|
| Brass Plate | Brass | For Regular Sheet Metal Machining Name Plates and Instrument Panels | High strength. Used in ductile. sliding parts. Brass | JIS H 3100 | | | | ○ |
| Free-cutting brass (Extruded bar) | Brass | General turming bolts screws, nuts, etc. | Good Machinability | JIS H 3250 | ○ | ○ | ○ | |

### 5. Cast and Forged Products, Copper Alloy Castings

| Class | Material Code | Use Application | Comment | JIS |
|---|---|---|---|---|
| Gray Cast Iron, Class 3 | Alloy Cast Iron Class No.30 | Cast Machine Parts | — | JIS G 5501 |
| Gray Cast Iron, Class 4 | Alloy Cast Iron Class No.35 | | — | JIS G 5501 |
| Spheroidal Graphite Cast Iron, Class 4 | FCD600 | | — | JIS G 5502 |
| Bronze Casting, Class 6 | BC6 | Bearings, sleeves, bushings and general machine parts. | High Pressure Tightness, Abrasion Resistance , Machinability | JIS H 5111 |

### 6. Steel Piping Materials

| Class | Material Code | Use Application | Comment | JIS |
|---|---|---|---|---|
| Carbon Steel Pipe for Ordinary Piping | White Pipe (Zinc Galvanizing) SGP<br>Black Pipe (No Plating) | Piping Parts | Operating pressure 10kgf/mm² at normal temperature (gas pipe).<br>A is metric specification. B is inch specification. | JIS G 3452 |
| Carbon Steel Pipe for Machine Pressure Service | STPG370 (STPG38) | Piping Parts | Operating pressure 100kgf/mm² at 350℃.<br>A is metric specification. B is inch specification. | JIS G 3454 |
| Carbon Steel Pipe for Structural Use | STKM | General Machine Parts Hollow Shafts | Available for class 11 to class 20. | JIS G 3445 |
| Seamless Brass Pipe (Regular Class) | C2700T | — | Easy Flaring, bending, wringing and plating | JIS H 3300 |

### 7. Spring Materials

| Class | Material Code | Use Application | Allowable Operating Temperature ˚C | JIS |
|---|---|---|---|---|
| Piano Wire | Spring Steel (ASTM A228) SWP-B | High strength, homogenous cold-drawn wire. For high quality springs and forming. | 110 | JIS G 3522 |
| Hard Steel Wire | SWB | Applicable to universal stress. For low priced springs and forming. | 110 | JIS G 3521 |
| | SWC | For high quality springs and forming. | 110 | |
| Carbon Steel for Spring Oil Tempered Wire | SWO-A<br>SWO-B | Hardening and tempered. For general-purpose springs. | 120 | JIS G 3560 |
| Carbon Steel for Valve-Spring Oil Tempered Wire | SWO-V | Hardening and tempered. With a fine surface and uniform tensile strength | 120 | JIS G 3561 |
| Cr—V Steel for Valve-Spring Oil Tempered Wire | SWOCV-V | Hardening and tempered. For impact loads and slightly high temperatures. | 220 | JIS G 3565 |
| Ci—Cr Steel for Valve-Spring Oil Tempered Wire | SWOSC-V | Hardening and tempered. For impact loads and slightly high temperatures. | 245 | JIS G 3566 |
| SUS Spring Wire for Spring | SUS302 (—WPA) (—WPB) | General corrosion and heat resistance. Available for magnetic spring. | 290 | JIS G 4314 |
| | 316 Stainless Steel (—WPA) (—WPB) | Good heat resistance. Higher corrosion resistance than SUS302. Available for magnetic spring. | 290 | |
| | 631 Stainless Steel-WPC | Precipitation hardening after spring processing. High strength and general corrosion resistance. Available for magnetic spring. | 340 | |





# Types and Apparent Colors of Surface Treatment

## Types of Surface Treatment

| Type | | Vickers Hardness (HV) | Layer Thickness (μm) | Applicable Material | Example | Purpose・Features | Remarks |
|---|---|---|---|---|---|---|---|
| Zinc Galvanizing | | — | 3～20 | Steel | Thin plate, Wire | ・Antirust, low price.<br>・Poor appearance. | — |
| Chromate Plating | | — | 1～ 2 | Steel | Plate work, Bolts and nuts | ・Antirust, low price.<br>・Fit for mass production. | — |
| Bright Chromate | | — | 1～ 2 | Steel | — | ・Poor appearance.<br>・Substitute for nickel plating. | |
| Nickel-Plating | | — | — | Steel, Copper, Brass | — | ・Improve corrosion resistance and decoration.<br>・Chromate plating has more corrosion resistance in the atmosphere. | ・Copper base plating as appropriate.<br>・Not applicable to deep indentations. |
| | Class 1 Plating | 500 | 5～20 | | | ・Better outer appearance than Class 3 plating. | ・Material→Buff→Plating→Buff |
| | Class 3 Plating | | | | | | ・Material→Plating |
| | Satin Finish Plating | — | — | | | ・Fatigue resistance.<br>・Minor scratches remain inconspicuous. | ・Material→Satin finish→Plating |
| Electroless Nickel Plating | | 500 | Can be specified | Steel, Stainless steel, Copper, Aluminum alloy, Glass, Plastic | Parts unsuitable for nickel plating. | ・Approx.10 times more expensive than nickel plating.<br>・Easy film thickness control.<br>・High corrosion resistance, abrasion resistance.<br>・Non-Metals become conductive. | — |
| Kanigen Plating | | Up to 1000 | | | Parts hardened after Plating. | ・Same as electroless nickel plating.<br>・Can be hardened by heat treatment after plating. | |
| Chrome Plating | | — | — | Steel, Copper, Brass | — | ・Lustering appearance.<br>・Good corrosion resistance.<br>・Sliding chrome plated surfaces stick together easily. | ・Nickel base plating as appropriate.<br>・Not applicable to deep indentations. |
| | Class 1 Plating | 500 | 5～20 | | | ・Better appearance than Class 3 plating. | ・Material→Buff→Plating→Buff |
| | Class 3 Plating | | | | | | ・Material→Plating |
| | Satin Finish Plating | — | — | | | ・Fatigue resistance.<br>・Minor scratches remain inconspicuous. | ・Material→Stain finish→Plating |
| | Hard Chrome Plating | 1000 | 10～30 | | Cylinder liners | ・Excellent fatigue resistance.<br>・More expensive than other chrome plating. | ・Material→Plate (Class 3 Plating) |
| Black Oxide (Blackening) | | — | — | Steel | Bolts, Nuts, instruments | ・Base coating.<br>・Lusts the appearance.<br>・Rusts more easily than parkerized materials. | ・General black oxide. (Blackening) |
| Raydent® | | — | 1～ 2 | Steel, Copper, Stainless steel | Items requiring high precision or higher corrosion resistance than blackening. | ・Long term antirust performance.<br>・High corrosion resistance.<br>・Ultra-thin film. | ・Low-temperature preliminary treatment. No thermal effect on raw material. Parts coupled with plastic matter, rubber, etc. |
| Alumite | Clear Anodizing | — | 3～ 5 | Aluminum alloy | — | ・Corrosion and abrasion resistance.<br>・No electric conductivity.<br>・Heat resistance | ・Some alumite pieces are colored through fine holes in the hard, oxidized film formed on the surface. |
| | Black Anodizing | — | 5～10 | | | | |

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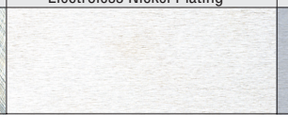
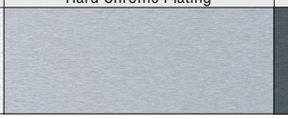
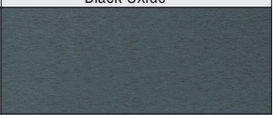
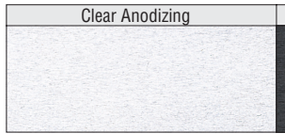
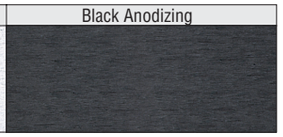
## Apparent Colors of Surface Treatment

| Bright Chromate | Electroless Nickel Plating | Hard Chrome Plating | Black Oxide |
|---|---|---|---|
|  |  |  |  |

| Clear Anodizing | Black Anodizing |
|---|---|
|  |  |