



4232 Temple City Boulevard  
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### Materials suitable for use in hermetically sealed products

Ametek HCC Industries manufactures a broad base of products ranging from single pin feed thru's to custom exotic material connectors and microelectronic packages. Below is a list of the various product categories currently manufactured by HCC. On each of the product classifications, there are 2 types of seals that can be achieved – dependent on the materials that are being used to make the hermetic interconnect assembly. The seals will either be matched or compression.

A matched seal is achieved when the Coefficient of Thermal Expansion (CTE) of the body material matches the CTE of the contact or electrode material. A common matched seal that is made every day at HCC is a Kovar seal. Kovar is material commonly used on Hybrid microelectronic packages (see types of materials and characteristics of this product family below).

A compression seal is achieved when the CTE of the outer member (body or housing) is greater than that of the inner member (contact or electrode), thus allowing for the outer member to mechanically compress against the insulator (glass) and the contact. Steel and Alloy 52 is a common combination of materials in a compression seal.

Below you will find a variety of materials currently used by HCC. We have provided details as to why each material is typically specified.

Please contact HCC for inquiries that you may have on any of the materials listed or on any material or material combination that is not listed below.

#### PRODUCT GROUPINGS

#### MATERIAL TYPES AND MATERIAL CHARACTERISTICS

##### 1. Terminals and Headers

###### 1.1. Body Materials

- 1.1.1. Cold rolled steel – lowest cost per unit weight of material
- 1.1.2. Kovar – when metal webbing is insufficient to support compression seals
- 1.1.3. 300 series Stainless steel – non-magnetic; corrosion resistant properties; welding compatibility to Stainless assemblies
- 1.1.4. Inconel – tensile strength; corrosion resistant; non-magnetic; excellent option for high pressure operating environments
- 1.1.5. Hymu 80 – tensile strength; corrosion resistance; non-magnetic; welding compatibility to Nickel based assemblies



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- 1.1.6. Titanium (Ti6Al4V & CP) – light-weight; non-magnetic; tensile strength; chemical resistant in specific applications; bio-compatible; welding compatibility to Ti assemblies
- 1.1.7. 17-4 PH – tensile strength; not directly sealed with glass due to phase transformation temperature but suitable for attachment by welding of Inconel glass-to-metal-seals (GTMS)
- 1.2. Contact materials
  - 1.2.1. Alloy 52 – for compression seals; flexibility on termination features – capable of having wire bond features formed into the contact
  - 1.2.2. Copper cored Alloy 52 – better electrical conductivity
  - 1.2.3. Kovar – for matched seals; flexibility of termination features
  - 1.2.4. 446 Stainless steel – weldable and corrosion resistant
  - 1.2.5. Molybdenum – weldable; chemical resistant
  - 1.2.6. Tantalum – weldable; chemical resistant
  - 1.2.7. Inconel – non-magnetic
  - 1.2.8. Copper – electrical conductivity; not directly sealed with glass but mechanically attached to intermediate sleeve
2. Microelectronic packages
  - 2.1. Body materials
    - 2.1.1. Kovar – low expansion to minimize stress when substrates are mounted – closely matches commonly used materials such as GaA
    - 2.1.2. Alloy 42 – lowest cost per unit weight of material
    - 2.1.3. Alloy 48 - to match CTE of special thermal bases
    - 2.1.4. 300 series Stainless steel – to match CTE of special substrates
    - 2.1.5. Monel – suitable for soldering without additional plating
    - 2.1.6. Invar – near-flat CTE curve at soldering temperatures
    - 2.1.7. Aluminum – thermal conductivity, light weight; machinable; weldable; - contacts are soldered in place
    - 2.1.8. Titanium (Ti6Al4V & CP) – light weight; bio-compatible; weldable – can be direct sealed
    - 2.1.9. Copper – thermal conductivity
    - 2.1.10. Tungsten-Copper Composites – thermal conductivity; heat dissipation required
    - 2.1.11. Molybdenum-Copper Composites - thermal conductivity; heat dissipation required
    - 2.1.12. AlSiC – light weight; thermal conductivity; heat dissipation required
    - 2.1.13. GlidCop – light weight; thermal conductivity; heat dissipation required
    - 2.1.14. Brass – thermal conductivity; not directly sealed - contacts are soldered in place
  - 2.2. Contact materials
    - 2.2.1. Kovar – for matched seals



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- 2.2.2. Copper cored Kovar – electrical conductivity
- 2.2.3. Alloy 52 – for compression seals
- 2.2.4. Copper cored Alloy 52 – electrical conductivity
- 2.2.5. Copper – electrical conductivity; not directly sealed in
- 2.2.6. Copper-Zirconium Composite – stiffness; conductivity
- 2.2.7. GlidCop – conductivity
- 3. Connectors
  - 3.1. Body materials
    - 3.1.1. cold rolled steel – lowest cost per unit weight of material
    - 3.1.2. Kovar – when metal webbing is insufficient to support compression seals
    - 3.1.3. 300 series Stainless steel – non-magnetic; corrosion resistant properties; welding compatibility to Stainless assemblies
    - 3.1.4. Inconel – tensile strength; corrosion resistant; non-magnetic; excellent option for high pressure operating environments
    - 3.1.5. Hymu 80 – tensile strength; corrosion resistance; non-magnetic; welding compatibility to Nickel based assemblies
    - 3.1.6. Titanium (Ti6Al4V & CP) – light-weight; non-magnetic; tensile strength; chemical resistant in specific applications; bio-compatible; welding compatibility to Ti assemblies
    - 3.1.7. 17-4 PH – tensile strength; not directly sealed with glass due to phase transformation temperature but suitable for attachment by welding of Inconel glass-to-metal-seals (GTMS)
    - 3.1.8. Aluminum – thermal conductivity; light weight; machinable; welding compatibility to Aluminum assemblies
    - 3.1.9. Hastelloy – corrosion resistance; suitable for soldering without additional plating; welding compatibility to Nickel based alloys
    - 3.1.10. Monel – corrosion resistant; suitable for soldering without additional plating; welding compatibility to Nickel based alloys;
  - 3.2. Contact materials
    - 3.2.1. Alloy 52 – for compression seals; flexibility on termination features
    - 3.2.2. Copper cored Alloy 52 – electrical conductivity
    - 3.2.3. Kovar – for matched seals; stiffness; flexibility on termination features
    - 3.2.4. 446 Stainless steel – corrosion resistant; stiffness; weldable
    - 3.2.5. 42-6 Stainless steel – stiffness; flexibility on termination features
    - 3.2.6. Alumel – thermocouple applications
    - 3.2.7. Chromel – thermocouple applications
    - 3.2.8. Iron – thermocouple applications
    - 3.2.9. Constantan – thermocouple applications



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### 3.2.10. Paliney 7 – used for specialized applications