

# [Copper to the increasing price of gold,](https://assignbuster.com/copper-to-the-increasing-price-of-gold/)

Copper Wire BondingICPAT Research Assignment           Name: Tay Ling Rong AnnabelStudent ID: S10166225KClass: P3V2For many years, Thermosonic ballbonding with gold (Au) wire has been the most widely acknowledged and commonlyused in many industries.

Due to the increasing price of gold, copper wire isused to replace gold wire in Thermosonic ball bonding. This report will give anelaboration on the advantages and disadvantages of using gold and copper wirein Thermosonic ball bonding. Wire bonding is the process ofmaking electrical connections between the contact area of the circuit and theexternal leads by using very fine wires. The wires used are usually made ofGold(Au) and Aluminum(Al), while Copper(Cu) is just starting to gain footing inthe semiconductor manufacturing industry. Gold Wire Bonding Gold wire bonding has been the mosttrustworthy and stable interconnect solution since its development about 50years ago, however the demand for cheaper costs, smaller outline packaging, accelerated and improved device performance, longer battery life has lead toengineers looking at flip chip ball bump connections as an alternative to wirebonding. The conductivity of Au is the bestamongst the other types of solder.

Au has the best electrical conductivitycompared to any other solder with an increase in thermal conductivity. Forexample, Au has an electrical resistivity of 2. 19 µ?-cm, while lead and its alloys has an electrical resistivity of 22 µ?-cm.            The process of making gold wirebonds:  A spark or small flame is used to melt the tip of the gold wire so as to form anorbicular ball which is about twice the diameter of the wire.

The ball is then thermosonicallywelded to a metallised pad on the semiconductor.  A loop of wire is formed as thebonding capillary moves across to the contact pad of the device package.   The wire is thermosonicallywelded to the metallised pad of the package.  The sharp edge on the tool isused to cut the wire, therefore leaving a length protruding to form the nextball.

Advantages of Gold Wire Bonding 1.   Good oxidation resistance2.   High-electrical conductivity3.   No bonding parameter required4.   Specifically refined to high purity (999. 99%Au)5.   Widely used around the world Disadvantage of Gold Wire Bonding 1.

Uneconomical as it is very costly2.   Low electrical and thermal properties3.   Low mechanical stability4.   Greater intermetallic growths  Copper Wire BondingCopper wire bonding is the process where the wire bonding processuses Copper (Cu) wires for interconnection. Over the years, Copper has been apopular material to use in the semiconductor industry because of its manybenefits as compared to Gold (Au).

One obvious reason that Copper is chosenover Gold is the cost. Copper is 3 to 10 times cheaper than Gold, thereforemany companies and industries have already switched to using Copper as theirmain material for interconnection. This can help companies save in theirproduction cost and in turn, increase their annual revenues. Other than thecost of the material, Copper wire are actually 25% more conductive as comparedto Gold, which is very important for the development of high performance andefficiency devices despite using small diameter copper wire to fit small padsizes. Advantages of Copper WireBonding1.    90% costreduction2.    Goodelectrical and thermal conductivity3.

Highmechanical stability4.    Lesserintermetallic growths Disadvantagesof Copper Wire Bonding1.    Oxidationat low temperatures2.

Requiresa bonding parameter due to its hardness3.    Comparativelynew, therefore Copper wire bonding technology is not as well understood as Goldwire bonding technologySummary of the advantages and disadvantages of Copper wires overGold wires Inconclusion, Copper wire bonding has more advantages over gold wire bonding. However, since it is still a relatively new technology, there are bound to havesome obstacles that need to be overcome. Therefore, in order to choose whichmaterial to use, it is important to consider the bonding application andsynthetic costs to make the perfect choice.               Referenceexsence(n.

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