

超高温石墨化炉专用低器身大功率水冷变压器

Low-body High-power Water-cooled Transformer for Ultra-high Temperature Graphitization Furnace

■ 产品概述(Product Introduction)

碳纤维 (carbon fiber, 简称CF), 是一种含碳量在95%以上的高强度、高模量纤维的新型纤维材料。它是由片状石墨微晶等有机纤维沿纤维轴向方向堆砌而成, 经碳化及石墨化处理而得到的微晶石墨材料。碳纤维质量比金属铝轻, 但强度却高于钢铁, 并且具有耐腐蚀、高模量的特性, 在国防军工和民用方面都是重要材料。非氧化环境下耐超高温, 耐疲劳性好, 比热及导电性介于非金属和金属之间, 热膨胀系数小且具有各向异性, 耐腐蚀性好, X射线透过性好, 良好的导电导热性能、电磁屏蔽性好等。

碳素材料在2500℃甚至3000℃炉温下烧结和石墨化是高性能碳纤维生产所必须采用的工艺, 因而加热电源配套的水冷加热变压器是关键器件。我公司配套的超高温石墨化炉专用大电流水冷变压器能够满足超高温石墨化炉T300到T1000碳纤维产品的工艺要求, 单机最大满载参数2*30KA/65VAC。为了保证高温炉的调温要求, 水冷变压器要具备原边大范围调压功能, 这给水冷变压器的研发制造提高了很大难度。经过精确的电气参数设计计算和科学的结构设计, 在保证产品的电气性能优良的前提下, 高压线圈采用全水冷饼式结构, 低压线圈采用水冷铜板式结构, 整体线圈为交错式分布轴向压装, 既降低了线圈高度, 且保证高效的散热。

Carbon fiber (CF) is a new type of fiber material with high strength and high modulus fiber containing more than 95% carbon. It is a microcrystalline graphite material obtained by stacking organic fibers such as flake graphite microcrystals along the axial direction of the fiber and undergoing carbonization and graphitization treatments. Carbon fiber is lighter than metal aluminum, but its strength is higher than steel. It has corrosion resistance and high modulus properties. It is an important material in national defense industry and civilian applications. It is resistant to ultra-high temperatures in a non-oxidizing environment. It has good fatigue resistance. Its specific heat capacity and conductivity are between non-metals and metals. It has a small thermal expansion coefficient and is anisotropic. It has good corrosion resistance, good X-ray transmittance, good electrical and thermal conductivity, and good electromagnetic shielding, etc.

The sintering and graphitization of carbon materials by furnace at temperatures of 2500℃ or even 3000℃ are necessary processes for the production of high-performance carbon fibers. So the water-cooled heating transformer supporting the heating power supply is a key component. Our company's high-current water-cooled transformer dedicated to ultra-high temperature graphitization furnace can meet the process requirements of carbon fiber products from T300 to T1000. The maximum full load parameter of a single machine is 2*30KA/65VAC. In order to ensure the temperature regulation requirements of high-temperature furnaces, the water-cooled transformer must have a large-range voltage regulation function on the primary side, which makes the development and manufacturing of water-cooled transformers very difficult. Be guaranteed the excellent electrical performance, after accurate electrical parameter design calculations and scientific structural design, the high-voltage coil adopts a fully water-cooled cake structure, and the low-voltage coil adopts a water-cooled copper plate structure. The overall coil is a staggered distributed axial press-fit, which not only reduces the coil height but also ensures efficient heat dissipation.



■ 产品特点(Product Feature)

- 1.铜管外包绝缘选用进口杜邦公司N0mex-T410绝缘材料, 半叠包多层缠绕, 保证产品绝缘和耐温的高可靠性。高压线圈采用水冷多饼式结构, 低压线圈采用水冷铜板式结构, 整体线圈为交错式分布轴向压装, 既降低了线圈高度, 且保证高效的散热。高压侧调压抽头用铜排幅向引出
- 2.铁芯内置水冷换热器, 强化铁芯散热能力。采用30Q120高导磁硅钢片, 同时采用先进的多级步进多级叠片方式, 有效降低了空载损耗、空载电流和噪声。在设计、制造过程中较好地消除了变压器大电流漏磁涡流引起局部发热问题, 产品具有极高的可靠性
- 3.水系统主管路采用铜管路, 满足防腐要求, 出水嘴采用国际标准的密封螺纹, 有效防止渗漏。分支连接管路采用耐高温尼龙纤维与橡胶符合管路或聚四氟乙烯管路, 保证可靠的耐温耐压耐久性。进出水设计温差低于5℃, 水流速设计值低于1.5m/s, 工作压力设计值低于3bar, 保证水冷系统工作的稳定可靠
- 4.铜管绕组引出端采用横向引出方式, 局部加强绝缘, 并根据客户要求对变压器采用“三防漆”处理(防盐雾、防湿热、防霉菌), 装饰性好, 耐腐蚀性强、保光性好、保色性较好, 有良好的流平性和遮盖力, 结构简化, 外形美观
- 5.整机满足IP56等级的防护要求

海绵钛真空自耗炉专用水冷变压器

Water-cooled Transformer for Sponge Titanium Vacuum Consumable Furnace

■ 产品概述(Production Introduction)

钛及其合金由于密度小(4.51g/cm³)、强度高(有的达到1000MPa)、比强度大、高低温性能优异,因此是首先被广泛应用于航空、航天等行业,成为军事工业不可或缺的结构材料。

直流真空熔炼是钛等稀贵金属及高性能合金钢熔炼所必须采用的工艺,因而真空电弧炉配套电源的水冷整流变压器是关键器件。我公司配套的直流真空自耗熔炼炉专用大电流水冷整流变压器能够满足真空自耗熔炼炉1T到12T的产品范围,单机最大满载参数2*36KA/60VDC。经过学习吸收世界名牌ALD公司先进技术,降低了现场安装整流变压器与整流柜之间大截面铜母排的难度,减小了整个电源的体积,缩小了占地面积。另考虑到熔炼过程中起弧电压为60V,而熔炼电压仅40V左右,应用了两套双反星形可控整流单元并联。随单炉可熔炼金属材料重量的不同为50~75V,熔炼过程中一般随单炉可熔炼金属材料重量的不同为30~45V,再次优化设计开发了全系列专用大电流水冷整流变压器。可根据客户要求在主电路中直流输出端增加平波电抗器。

本公司生产的水冷整流变压器用作整流装置的电源变压器,主要应用于海绵钛真空自耗炉等稀有金属冶金行业。该产品具有损耗低、噪声低、结构紧凑、供电可靠、抗冲击和抗短路能力强等优点,并可以根据客户要求定制多结构形式多脉波的水冷整流变压器。

Titanium and its alloys are widely used in aviation, aerospace and other industries due to their low density (4.51g/cm³), high strength (some reaching 1000MPa), high specific strength, and excellent high and low temperature properties, and have become indispensable structural material for the military industry.

DC vacuum melting is a necessary process for melting titanium and other rare and precious metals and high-performance alloy steel. Therefore, the water-cooled rectifier transformer is a key component for the vacuum electric arc furnace supporting power supply. Our company's high-current water-cooled rectifier transformer dedicated to DC vacuum consumable melting furnace can meet the range of vacuum consumable melting furnaces from 1T to 12T, and the maximum full load parameter of a single machine is 2*36KA/60VDC. After learning and absorbing the advanced technology of the world-famous ALD company, we have reduced the difficulty of on-site installation of large-section copper busbars between the rectifier transformer and the rectifier cabinet, and reduced the size of the entire power supply and the floor space. In addition, considering that the arcing voltage during the smelting process is 60V, while the smelting voltage is only about 40V, two sets of double reverse star controllable rectifier units in parallel are used. Depending on the weight of the metal material that can be smelted in a single furnace, the voltage is 50 ~ 75V. During the smelting process, generally depending on the weight of metal materials that can be smelted in a single furnace, the voltage is 30 ~ 45V. We have optimized the design and developed a full series of dedicated high-current water-cooled rectifier transformers. A smoothing reactor can be added to the DC output of the main circuit according to customer requirements.

Our water-cooled rectifier transformer is used as power transformers for rectifier devices. It is mainly used in rare metal metallurgical equipment such as sponge titanium vacuum consumable furnaces. This product has the advantages of low loss, low noise, compact structure, reliable power supply, strong impact resistance and short-circuit resistance. Water-cooled rectifier transformers with multiple structures and multiple pulse waves can be customized according to customer requirements.

■ 产品特点(Product Feature)

- 1.电气性能稳定:结合行业应用特点优化设计方案。精确的电气参数设计和科学的结构设计,保证产品的电气性能优良,高压线圈采用风冷设计(国内布置)或水冷设计(欧洲布置),采用轴向多风道结构,降低通风阻力,保证高效的通风和散热。低压线圈采用水冷结构,保证高效的散热
- 2.动稳定程度高:产品高压绕组箔绕(国内布置)或饼式叠压(欧洲布置),低压线圈采用铜管或铜板绕组(国内布置)或铜板拼焊绕组(欧洲布置),有极高的机械强度,具有较强的抗突发能力,以满足极恶劣的负载环境
- 3.热稳定性好:先进仿真计算,优化产品的发热部位及最热点温升,留有充分的温升裕度,选用进口杜邦公司N0mex-T410绝缘材料,保证产品绝缘和耐温的高可靠性。根据水冷散热特性,合理分配水冷管路水流量,达到最佳冷却效果,铁芯内置水冷换热器,强化铁芯散热能力,采用30Q120高导磁硅钢片,同时采用先进的多级步进多级叠片方式,有效降低了空载损耗、空载电流和噪声。在设计、制造过程中较好地消除了变压器大电流漏磁涡流引起局部发热问题,产品具有极高的可靠性

