Recent Trends and Application of Peek Material

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Abstract:- *As a special plastic engineering plastic with excellent mechanical properties, polyetheretherketone (PEEK) has a larger range of applications. The self-lubricating composite materials based on polyetheretone (PEEK) have low friction factor characteristics and good wear strength and can be used in harsh environments such as non-sticking, high temperature, moisture, contamination and corrosion. The field is wide-ranging. The focus of strategic competition among countries is on new materials as a leading industry in domestic economics and high-end production and a major guarantee for the defence industry. The new materials industry in my country is continually improving its strategic position. Everyone needs to work together during the critical time of transformation and development to find new directions for development and prospects for transformation, improvement and sustainable development so quickly as possible. This paper discusses PEEK's recent developments and applications*

Key words: *polyetheretherketone, polyetheretone, low friction factor, temperature, moisture, contamination and corrosion, defence industry*

1 Introduction:- It is polyimide, polyarylether and polyarylate. The typical representative of Plastics is polyarylene ethers, mainly including polyarylene ether ketone, polyarylene ether ketone and polyarylene ether. Aryl ether sulfone and polyarylene sulfide. Polyarylene ether ketone is the three types of polymers.

The highest heat resistance grade in the middle, and the main ones that have been successfully developed are poly Ether ether ketone, polyether ketone ketone (PEKK), polyether ketone (PEK), polyether ether Ketone ketone (PEEKK) and polyether ketone ether ketone ketone (PEKEKK). Among them, PEEK is the most important variety of polyaryletherketone polymers. The molecular chain of PEEK contains a large number of benzene rings, which has excellent substances. Physical and chemical properties, mechanical and thermal properties, such as melting point up to 343℃. The glass transition temperature is 143℃, and it can maintain a relatively high temperature at 250℃.

High abrasion resistance and low friction coefficient, the tensile strength is up to 100MPa, etc. Because it has heat resistance, abrasion resistance, and fatigue resistance Resistance, radiation resistance, peel resistance, creep resistance, dimensional stability, resistance Excellent comprehensiveness of impact resistance, chemical resistance, non-toxicity, flame retardancy, etc.

Yes, and the two ether bonds and the carbonyl group provide the material with flexibility and Excellent manufacturability [1]. Therefore, PEEK is used in electronics, electrical, aviation and aviation. Many fields such as sky, automobile, energy, other industries, and medical care are widely used. General application [2G5]. There are currently three main types of PEEK: pure resin PEEK, glass fiber modified PEEK and carbon fiber modified PEEK.

2 Application

2.1 Aerospace

It has excellent mechanical and chemical properties, It is easy to be processed into parts with very small tolerances and has excellent flame retardant properties. The earliest application field developed is aerospace, due to aviation. The particularity of the field requires flexible processing, low processing cost and resistance to evil. Lightweight materials that are inferior to the environment. In order to comply with the lightweight trend of aviation materials. At the same time, aircraft manufacturers are increasingly favoring alternative aluminum and other metal materials.

Engineering plastics for the manufacture of various aircraft parts [6G8]. From brackets and frames Sub, clamps to radome, hubcaps, etc. have now been successfully used. The application of PEEK materials has gradually shifted from the initial interior parts to Force member transition. In addition, PEEK resin can also be used to make fuel, Box cover, aircraft door accessories and rocket engine parts, etc.

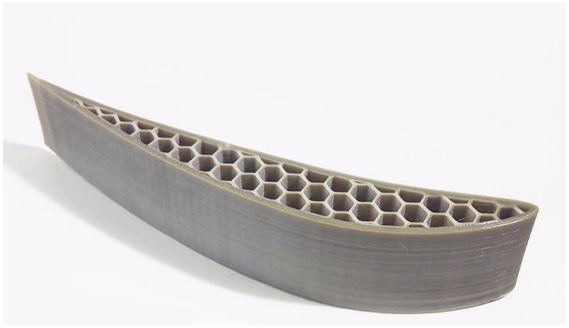

Figure 1: Peek Material in Aerospace

2. 2 Electronics and electrical

The emergence of consumer electronics accelerates the integration of electronic components. With the development of miniaturization, the requirements for manufacturing materials are also increasing. Because PEEK has excellent electrical properties, it is an ideal electrical Insulator, in harsh working environment such as high temperature, high pressure and high humidity Under the components, it can still maintain good electrical insulation, so the electronic and electrical field. It has gradually become the second largest application field of PEEK. PEEK is available Used in the manufacture of aluminum capacitor shells and wafer boxes for silicon wafer processing. Due to the excellent mechanical properties of PEEK, it can also be used to make thin films. Lines, various connecting devices, back pressure regulator membrane linings, connectors, sensors Etc. India is one of the world's important electronic product processing bases. Therefore, the demand for PEEK resin in this field will continue to grow.

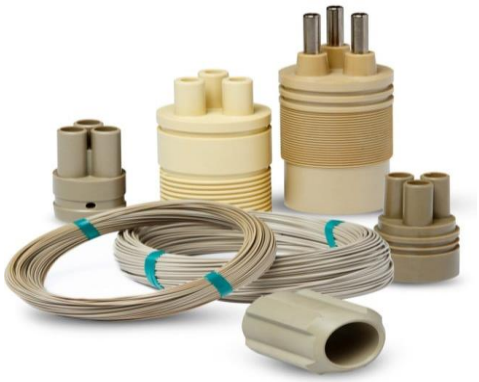

Figure 2: Peek Material in Electronics and Electrical

2.3 Automotive field

Similar to the aviation field, PEEK is also suitable for realizing automotive Lightweight parts can replace metal stainless steel and titanium. And gradually From interior decoration parts and functional materials to exterior parts, structural parts, etc. There is a huge potential for replacing steel with plastic. Using PEEK's good resistance Friction and mechanical properties can be used to manufacture engine inner covers, manufacturing ABS valves, gaskets, etc. in automobile bearing transmission, braking and air-conditioning systems Clutch gear ring and other various parts [9], in addition, it can also be used to manufacture vortex Wheel compressors, pumps, valves, wires and cables, seat adjustment parts, standard parts, etc. According to foreign reports, there are more than 40 parts and components that can be used in cars PEEK to manufacture. Not only some well-known foreign automobile brand companies have After extensive use of PEEK resin, some domestic automobile manufacturers Diesel engine, gasoline booster vacuum pump, rolling bearing and automatic change PEEK reinforced resin is also used in the seal ring in the speed controller.

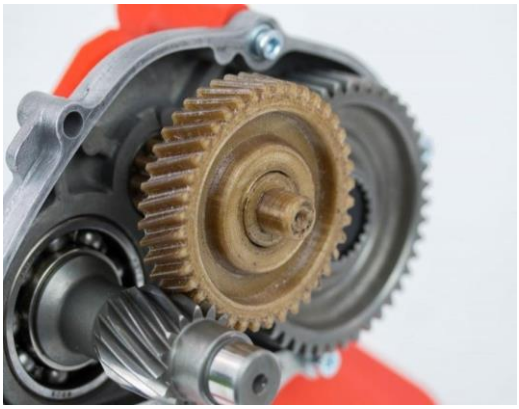

Figure 3: Peek Material in Automotive Field

2. 4 Industrial field

PEEK has excellent dimensional stability, high rigidity, and excellent Friction performance, no exhaust gas generated during processing, easy to process and able to withstand High and low pressure, commonly used to make compressor valves, piston rings, and seals etc. [10]. At present, nearly 100 domestic enterprises have begun to adopt PEEK resin production related products, mass production of PEEK resin Production has driven the development of the domestic PEEK resin products industry.

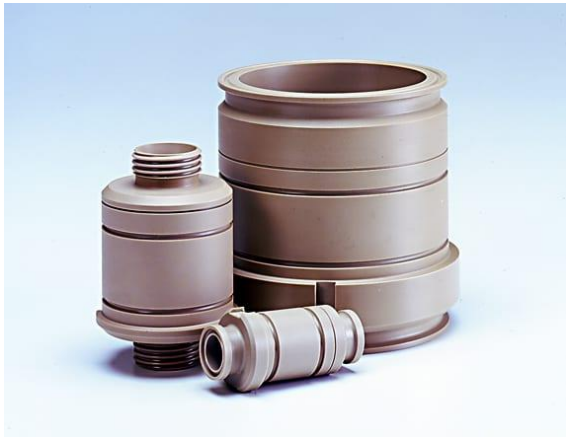

Figure 4: Peek Material in Industrial Field

2. 5 Medical field

In the 1990s, the biocompatibility of PEEK passed Laboratory and clinical approval, PEEK biomaterial research started. And because of the artificial bone made by PEEK, It has received widespread attention.

It has the advantages of light weight, non-toxicity, and strong corrosion resistance. Close materials can be organically combined with the body, so in recent years, PEEK As an emerging implant, it is used in intervertebral fusion cages, artificial joint replacements, A variety of

orthopedic surgery such as trauma implantation and oral cavity [11G12]. Expected In the next few years, the demand for PEEK in the domestic medical field will increase Faster.

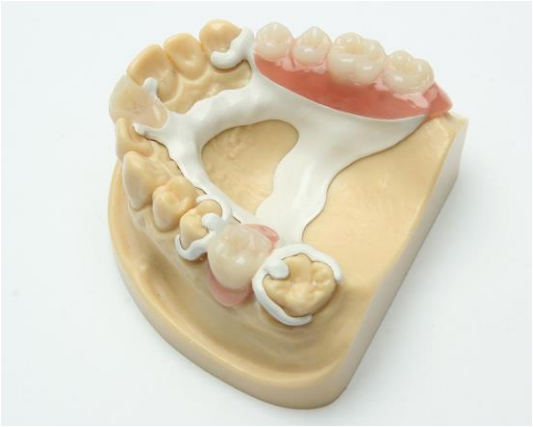

Figure 5: Peek Material in Medical Field

3 Development Trend

With the rapid development of global technology and economy, countries around the world have the materials needed in the field increasingly require high efficiency, energy saving, and environmental protection, such as transportation Aviation materials and auto parts in the transportation industry tend to be lightweight. This in turn reduces fuel consumption, improves flight efficiency, and reduces flight costs. Reduce CO2 emissions, based on the excellent comprehensiveness of PEEK materials. Yes, it can provide good reliability for aircraft, rockets, and car bodies Security and safety. Electronic information technology has developed rapidly in recent years. Components are developing in the direction of integration and miniaturization, and PEEK resin The material just can provide an ideal solution for the selection of related materials Cases, with the improvement of people's material living standards, health has become more and more. More important, with the increase of the global aging population, there is a surge in demand for medical services, and people's requirements for medical materials are increasing. The higher you come, you are no longer satisfied with traditional metal materials or titanium alloy materials. Material, and medical PEEK material is due to its unique performance, the potential of the field is huge, and with the emergence of 3D printing technology, it is expanding Broaden the scope of application of PEEK resin.
The field prospects are broad. New materials as a leading industry in the national economy and high-end manufacturing and the key guarantee for the defense industry is the focus of strategic competition among countries. The strategic position of my country's new material industry is constantly improving. At the critical period of transformation and development, everyone needs to work together to find New development directions and prospects to achieve transformation, upgrading and sustainability as soon as possible. The material industry is developing towards new materials, promoting the upgrading of key materials. In the mid-to-high-end industry, PEEK is a key national strategy.

4 Conclusion and Outlook

The material industry is the basic industry of the national economy, and new materials. The leader of the development of the material industry is an important strategic emerging industry. With the development of science and technology, people's requirements for materials will become higher and higher. Especially in the current energy shortage, reducing weight and cost is a must for every enterprise. Issues to be considered, replacing steel with plastic is the inevitable trend of future material development Potential, and PEEK is the most important material in special engineering plastics. It is widely used in military and civilian fields around the world, and the demand is also high. There will be more and more applications, and the application fields will become wider and wider. Market demand Is steadily increasing year by year, especially the rapid growth of domestic market demand. The prospects are promising. At present, my country has initially realized the industrialization of PEEK. The products of some companies have reached the international level. But from the laboratory to the work There are many difficulties in the process of industrialization, mainly as follows:

Aspects of the problem.
(1) The reaction equipment ranges from glass flasks in the laboratory to hundreds of liters or With a reactor of several thousand liters, this process is not just a simple amplification. During the polymerization process of PEEK, the reaction system is very viscous. The material flows steadily and evenly in the reactor. Therefore, it is necessary to the configuration of the agitator and the shape and quality of the stirring blade are repeatedly designed and verification.

(2) As a polycondensation reaction, each reaction raw material of PEEK, all need accurate weighing and proportioning, otherwise the performance of the material will be affected. For laboratories, such weighing is simple, but for industrialized production, the input volume of a single tank is as high as several tons, which needs to be controlled. It is very difficult to contain the error, so the reaction ratio is accurately controlled It is an important difficulty.
(3) Temperature control is difficult, it needs to reach 300°C or higher. The reaction temperature is kept stable, and the heating method and heat preservation method are both It is a huge challenge and requires very precise temperature control.
(4) The purification process is a big problem in industrial

production. In terms of efficiency and cost, it requires repeated exploration, and it needs to be in the shortest time to achieve the best purity within. In addition, for solvent recovery, gas protection, etc. It takes a lot of technical practice and accumulation of production experience to ensure the work realization of industrialization. Therefore, the world can industrialize PEEK. There are very few companies in the country, and only in the domestic PEEK production companies research shares have achieved thousands of tons of large-scale industrialization. Therefore, other domestic production enterprises should promote production technology, improve production technology, and adjust Industrial structure, increase investment, accelerate key technology upgrades, and expand It is imperative for domestic and foreign markets.

References

[1]. Wang Baocheng, Li Kun, Zhou Haiou. Development and research of high-performance engineering plastic polyether ether ketone [J]. Chemical Technology, 2006, 14(5): 46G48.
[2]. BalajiV, TiwariAN, GoyalRK. Fabricationandpropertiesof highperformancePEEK/Si3N4nanocomposites[J]. Journalof Applied Polymer Science, 2011, 119(1): 311G318.
[3]. TharajakJ, PalathaiT, SombatsompopN. Morphological and physical properties and friction/wearbehaviorofhGBNfilled PEEKcompositecoatings[J]. Surface& CoatingsTechnology, 2015, 273: 20G29.
[4]. KalinM, ZalaznikM, NovakS. Wearandfrictionbehaviourof polyGetherGetherGketone(PEEK)filled withgraphene,WS2 andCNTnanoparticles[J]. Wear,2015,332G333:855G862.
[5]. MiyazakiT, MatsunamiC, Shirosaki Y. BioactivecarbonG PEEKcompositespreparedbychemicalsurfacetreatment[J]. MaterSciEngC MaterBiolAppl, 2017, 70: 71G75.
[6]. Chen Haoran, Li Yong, return the army, etc. Quality Control of Preparation of Thermoplastic Automatic Laying Pre-impregnated Yarn System and performance research [J]. Acta Aeronautica Sinica, 2018, 39(6): 228G237.
[7]. Li Changlin, Huang Zhigang, Weng Yunyi. Research on Wear Resistance Modification of PEEK Special Engineering Plastics Progress and application prospects [J]. China Plastics, 2018, 32(4): 18G23.
[8]. Zhang Ting. Application of high-performance thermoplastic composite materials in the structural parts of large passenger aircraft[J]. Aviation Manufacturing Technology, 2013, 435(15): 32G35.
[9]. Lin Youxi, Gao Chenghui. Research on polyether ether ketone composite materials for automobiles [J]. Automotive Technology, 2005, 10(12): 40G43.
[10]. Wang Feng, Wang Zijun, Li Jianxing and others. Polyetheretherketone composite material for high-speed bearing cage Material forming process [J]. Bearing, 2009(1): 31G33.
[11]. FeerickEM, KennedyJ, MullettH, etal. InvestigationofmeG tallicandcarbonfibrePEEK fracturefixationdevicesfor threeGpartproximalhumeralfractures[J]. MedicalEngineerGing& Physics, 2013, 35(6):712G722.
[12]. Chen Tianjie, Liu Hong, Liu Chengshen, etc. Polyetheretherketone composite materials in the field of stomatology Application in [J]. Journal of Modern Stomatology, 2017(6): 50G53.