

1.

用英文作自我介绍

回答问题：

请简单说明什么是聚合物的粘弹性，并说明它与低分子液体流动的区别？

朗读并翻译以下段落

Larger diameter (50-10nm) vapor grown carbon nanofibers can be well dispersed in polypropylene melt, while single wall carbon nanotubes (swnt) were not as well dispersed, techniques such as end-group functionalization, use of ionic surfactants, shear mixing and plasma coating have been used to improve dispersion and exfoliation of carbon nanotubes in polypropylene compatibility with fillers has been improved by matrix modification by grafting it with reactive moieties, such as acrylic acid, acrylic esters, and maleic anhydride.

2. 高聚物与高聚物之间相容性的好坏可以通过什么方法加以评价？

A new copolyamide, nylon 6/11, was prepared by hydrolytic polymerization and melt polycondensation and characterized by means of intrinsic viscosity, Fourier transform infrared (FTIR) spectroscopy and differential scanning calorimetry (DSC) in this paper. It was found that the intrinsic viscosity of nylon 6/11 copolymerization time under vacuum. However, the incorporation of caprolactam into nylon 11 chains did not transform the crystal phase of nylon 11.

3. 请问聚合物分子量的测试方法有哪些？并描述其中两种测试方法的测试原理？

Solutions of poly(ethylene-co-vinyl alcohol) or PEVOH, ranging in composition from 56 to 71 wt% vinyl alcohol, can be readily electrospun at room temperature from solutions in 70% 2-propanol/water. The solutions are prepared at 80°C and allowed to cool to room temperature. Interestingly, the solutions are not stable at room temperature and eventually the polymer precipitates after several hours. However, prior to precipitation, electrospinning is extensive and rapid, allowing coverage of fibers on various substrates. Fiber diameters of ca. 0.2-0.8 µm were obtained depending upon the solution concentration.

4. 用于生产合成纤维的高分子的分子量与橡胶、塑料相比有什么不同，结构有何差异？

The use of macromonomers is a convenient method for preparing branched polymers. However, graft copolymers obtained by conventional radical copolymerization of macromonomers often exhibit poorly controlled molecular weights and high polydispersities as well as large compositional heterogeneities from chain-to-chain. In contrast, the development of “living”/controlled radical polymerization has facilitated the precise synthesis of well-defined polymers with low polydispersities in addition to enabling synthetic chemists to prepare polymers with novel and complex

architectures.

5.如何测定 Avrami 指数？Avrami 指数物理学上有什么意义？

The thermal and electrical conductivities in nanocomposites of single walled carbon nanotubes (swnt) and polyethylene (pe) are investigated in terms of swnt loading, the degree of PE crystallinity, and the pe alignment. Isotropic swnt/PE nanocomposites show a significant increase in thermal conductivity with increasing swnt loading, having 1.8 and 3.5 W/mK at a swnt volume fraction of  $\sim 0.2$  in low-density pe (ldpe) and high-density PE (hdpe), respectively. This increase suggests a reduction of the interfacial thermal resistance. Oriented swnt/hdpe nanocomposites exhibit higher thermal conductivities, which are attributed primarily to the aligned pe matrix.

6.请陈述你对“高分子”的理解？在你印象中，你知道哪些常用的聚合物品种？请列举其中两种聚合物品种的应用？

We previously discovered that isotropic monomer solution shows birefringence due to its anisotropic structure after gelation in the presence of a small amount of rod-like polyelectrolyte. Here, we focus on what mechanism is responsible for the formation of anisotropic structure during gelation. Various optical measurements are performed to elucidate the structure change during gelation. It is found that the existence of a large-size structure in monomer solution with the rod-like polyelectrolyte is essentially important to induce birefringence during gelation.

7.如何提高尼龙 66 的分子量？

This work examines the pbt/pet sheath/core conjugated fiber, with reference to melt spinning, fiber properties and thermal bonding. Regarding the rheological behaviors in the conjugated spinning, pet and pbt show the smallest difference between their melt-viscosity at temperatures of 290 and 260 respectively, which has been thought to represent optimal spinning conditions. The effect of processing parameters on the crystallinity of core material-pet was observed and listed. In order of importance, these factors are the draw ratio, the heat-set temperature, and the drawing temperature.

8.你对白色污染有何看法？你认为可以实现高分子得循环利用吗？

Thermoresponsive shape memory fibers were prepared by melt spinning from a polyester polyol-based polyurethane shape memory polymer and were subjected to different postspinning operations to modify their structure. The effect of drawing and heatsetting operations on the shape memory behavior, mechanical properties, and structure of the fibers was studied. In contrast to the as-spun fibers, which were found to show low stress built up on straining to temporary shape and incomplete recovery to the permanent shape, the drawn and heat-set fibers showed significantly higher stresses and complete recovery.

9.在自由基聚合中存在反应的自加速现象，请简单说明产生的原理并说明如何采用措施来调整反应的速率？

The dry-jet-wet spinning process was employed to spin poly(lactic acid) fiber by the phase inversion technique using chloroform and methanol as solvent and nonsolvent, respectively, for PLA. The as-spun fiber was subjected to two-stage hot drawing to study the effect of various process parameters, such as take-up speed, drawing temperature, and heat-setting temperature on the fiber structural properties. The take-up speed had a pronounced influence on the maximum draw ratio of the fiber. The optimum drawing temperature was observed to be 90 to get a fiber with the tenacity of 0.6 GPa for the draw ratio of 8.

10.什么是晶体，如何测定晶胞参数，密勒指数，高分子材料的结晶行为与小分子材料比有什么区别？

The electrostatic spinning technique was used to produce ultrafine polyamide-6 fibers. The effect of solution conditions on the morphological appearance and the average diameter of as-spun fibers were investigated by optical scanning and scanning electron microscopy techniques. It was shown that the solution properties (i.e. viscosity, surface tension and conductivity) were important factors characterizing the morphology of the fibers obtained. Among these three properties, solution viscosity was found to have the greatest effect. Solutions with high enough viscosities were necessary to produce fibers without beads.

11.如何测定高分子的分子量，不同的方法得到的结果有什么差异？

Ternary blend fibers (TBFs), based on melt blend of poly(ethylene 2,6-naphthalate), poly(ethylene terephthalate), and a thermotropic liquid-crystal polymer (TLCP), were prepared by a process of melt blending and spinning to achieve high performance fibers. The reinforcement effect of the polymer matrix by the TLCP component, the fibrillar structure with TLCP fibrils of high aspect ratios, and the development of more ordered and perfect crystalline structures by an annealing process resulted in the improvement of tensile strength and modulus for the TBFs.

12.高分子材料制成制品需要经过成型加工步骤。请问聚合物纤维的加工成型方法主要有哪些？

Polymers carrying a hydrolyzable ester function and bactericidal quaternary ammonium salts were successfully synthesized in two steps. The first one was the modification of hydroxyl functions of poly(vinyl alcohol) by chloroacetic anhydride. The structure of synthesized polymers was confirmed by infrared, and nuclear magnetic resonance. The kinetic results were consistent with a 1-order reaction, and the activation energy in the case of total modification was found to be 16.8 kJ/mol. The second step was the quaternization of the pendant chlorine atom with a long alkyl chain or aromatic tertiary amines.

13.你对聚合物的表征有哪些了解？请列举表征方法并说明其主要用途？

Blending homopolymers with block copolymers has been proved to be another interesting approach to modify the morphology of the block copolymer self-assembly. By blending homopolymer of identical chemical structure with one block in the copolymer, the dimension of the domains in the final phase separation has been adjusted, by changing either the volume fraction or the molecular weight of the homopolymer. At low volume fraction of the block copolymers, the structure formation is analogous to micelle formation of surfactant molecules in solutions, and the interfacial tension between the copolymer and the homopolymer is a critical factor.

14.高分子溶液的粘度和哪些因素有关？

Differential scanning calorimetry and dynamic mechanical thermal analysis techniques have been used to characterize different Kevlar/epoxy composites. Tetra-functional aliphatic amine and anhydride/diglycidyl epoxy have been used as matrix, and different quantities of continuous Kevlar fibers as reinforcement. Kevlar fibers had different effects on curing kinetics and final thermal properties depending on epoxy matrix type. A significant decrease in the glass transition temperature ( $T_g$ ) was observed as Kevlar content increased when anhydride matrix was used.

15.液晶高分子材料按液晶结构的差异可以分为哪几类？液晶纺丝主要应用哪一类液晶的特性？

Graft copolymerization is an efficient method to modify polymers. Various vinyl monomers have been investigated to graft onto starch, and the starch graft copolymers have been used as flocculating agents, superabsorbents, ion exchanges and matrix or filler of thermoplastics. In this paper, modified starch paste by grafting with butylacrylate (BA) is firstly investigated as rubber reinforcing fillers. Three types of natural rubber (NR)/starch composites are prepared. Properties and morphology of these composites and corresponding starch powders are examined. The observed reinforcement effect of modified starch powder on NR/starch composites is interpreted.

16.在分子的发展过程中曾经经历了聚合物新品种层出不穷的时期，目前，分子的发展主要集中对已有聚合物品种的功能化改性。你知道聚合物的改性方法有哪些？

To prevent the loss of fiber strength, ultrahigh-molecular-weight polyethylene (UHMWPE) fibers were treated with an ultraviolet radiation technique

combined with a corona-discharge treatment. The physical and chemical changes in the fiber surface were examined with scanning electron microscopy and Fourier transform infrared/attenuated total reflectance. The gel contents of the fibers were measured by a standard device. The mechanical properties of the treated fibers and the interfacial adhesion properties of UHMWPE-fiber-reinforced vinyl ester resin composites were investigated with tensile testing.

#### 17. 高压聚乙烯，低压聚乙烯的主要区别？

Bicomponent fibers were wet-spun from soybean protein and poly(vinyl alcohol). The protein core of the spun bicomponent fiber was brittle. Our effort was then to study the soybean protein solution, with the aim of trying to understand the cause for fiber brittleness and to determine the optimum solution conditions for fiber spinning. The effects of alkali, urea, and sodium sulfite on the viscosity of the soybean protein solution was examined at various pH values at two temperatures.

#### 18. 有哪些方法可以测定聚合物的取向，他们测得的数据有什么差异？

Chemical vapor deposition (CVD) is the most promising synthesis route for economically producing large quantities of carbon nanotubes. We have developed a low-cost CVD process for the continuous production of aligned multiwall carbon nanotubes (MWNTs). Here we report the effects of reactor temperature, reaction time, and carbon partial pressure on the yield, purity, and size of the MWNTs produced. A simple method for purifying and healing structural defects in the nanotubes is described.

#### 19. 橡胶为什么具有弹性，对于应用于橡胶材料的高分子结构上有什么要求？有哪些常见的橡胶种类？

We previously reported that an aqueous slurry of  $\text{MoO}_3$  can be used to directly deposit the compound onto supports such as activated carbon, alumina, boehmite and titania. The impregnation method is referred to as slurry impregnation or solvent-assisted spreading. The solubility of  $\text{MoO}_3$  in water is low but sufficient for its gradual dissolution and adsorption onto the support surface. The aim of the present work was to use the solvent assisted spreading method to prepare  $\text{MoO}_3$  catalysts supported on zirconia. Commercially available  $\text{ZrO}_2$  pellets with a specific surface area 108  $\text{m}^2/\text{g}$  and an industrial sample of high surface area hydrous zirconia were selected for this purpose.

#### 20. 请问聚合物的聚合方法有哪些？哪些聚合方法能实现对聚合物结构的精确控制？

Three-dimensional silica fiber reinforced silicon nitride-based composites were fabricated through polyhydridomethylsilazane pyrolysis at 500-600 °C in flowing

anhydrous ammonia atmosphere. The characteristics of the precursor-derived product, the mechanical properties and microstructures of the composites were investigated by FT-IR, elemental analysis, XRD, flexural strength and SEM. The composites were amorphous, showing a high flexural strength of 114.5 MPa and a non-brittle failure behavior.

21. The crystallization behavior of fluorophlogopite, a glass-ceramic located in MgO-SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>-K<sub>2</sub>O-F system was studied by varying the B<sub>2</sub>O<sub>3</sub> content in the glass composition. DTA analysis revealed that the first peak crystallization temperatures ( $T_{c1}$ ) and glass transition temperature increased with increasing the particle size of each composition. DTA and XRD results indicated that the phlogopite crystallites probably transform monoclinic to trigonal (3t) polytype at a temperature in the range of 950-1000.

22. We report the deformation behavior of the Ni-based bulk metallic glass (BMG) by spark plasma sintering of amorphous powders, which have been prepared by a gas atomization. By spark plasma sintering of amorphous powders in the supercooled liquid region, a fully Ni-based BMG was successfully synthesized. Full densification was achieved by viscous flow of the amorphous powders in the supercooled liquid region during consolidation process. The strength of about 2.4 GPa was obtained in the consolidated BMG, which is comparable to that of the as-cast BMG (2.6 GPa).

23. An increase in porosity content caused degradation in thermal-fatigue life and other mechanical properties. The fractographic examinations identified the pores and some intermetallics as the key microstructural features which promote damage and thermal-fatigue crack initiation sites in the specimens. Crack initiation and propagation is expected to occur sooner in regions of higher defects such as pores and large intermetallics. Progressive cyclic plastic deformation was also observed in constrained thermal-fatigue specimens.

测定结晶度的主要方法有哪些？简述影响结晶度的主要因素？

请谈谈你对时温等效原理的认识。