Separation Techniques 2018: Enabling innovative process solutions with tight nanofiltration ceramic membranes - Tracy Bantegui- Cerahelix Inc

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Poly(3-hydroxybutyrate-co-3-hydroxyvalerate)-block-poly(3-hydroxybutyrate) copolymer (P3HBV-b-P3HB) was biosynthesized by addition of pentanoic acid and glucose as carbon sources by Ralstoniaeutropha. First, pentanoic acid was metabolized for 72 h to provide P3HBV, and, after changing to a new medium, glucose was used as a second carbon source to give P3HB. In order to regulate the chain length of P3HB, the cultivation time of glucose was varied from 24 h to 96 h. The index of randomness of the butyrate and valerate units (D) was estimated based on the resonance line of the carbonyl carbon in the 13C NMR spectrum. The D value was between 3.7 and 9.2 depending on the glucose cultivation time, corresponding to the formation of a block copolymer. The chain lengths of the P3HBV and P3HB blocks were estimated from these values. It was found that as the cultivation time of glucose increased, the chain length of the P3HBV block accumulated at the initial stage decreased, whereas that of the P3HB block increased. This indicates that the P3HBV block was consumed as an energy source for the activity of the microorganism while more of the P3HB block was accumulated, because the end group was active for polymerization.

The distinguishing feature of the materials covered in this book is that they all have low densities. Densities range from as low as 0.80 g/cm3 (0.030 lb/in.3) for unfilled polymers to as high as 4.5 g/cm3 (0.160 lb/in.3) for titanium. While the density of titanium is high compared to unfilled polymers, it is significantly lighter than the metals it usually competes with—alloy steel at 7.86 g/cm3 (0.283 lb/in.3) and superalloys with densities that range from 7.8 to 9.4 g/cm3 (0.282 to 0.340 lb/in.3). In addition, unfilled polymers have rather low tensile strengths that range from 34 to 103 MPa (5 to 15 ksi), while unidirectional carbon/epoxy can attain tensile strengths as high as 2410 MPa (350 ksi). Some of the lightweight materials can only be used to approximately 66 °C (150 °F), while others maintain useful properties to over 1370 °C (2500 °F). Therefore, as shown in Table 1.1, the lightweight materials covered in this book cover a wide range of properties and, as a result, fulfill a wide range of applications.

Aluminum is an industrial and consumer metal of great importance. Aluminum and its alloys are used for foil, beverage cans, cooking and food processing utensils, architectural and electrical applications, and structures for boats, aircraft, and other transportation vehicles. As a result of a naturally occurring tenacious surface oxide film (Al_2O_3), a great number of aluminum alloys have exceptional corrosion resistance in many atmospheric and chemical environments. Its corrosion and oxidation resistance is especially important in architectural and transportation applications. On an equal weight and cost basis, aluminum is a better electrical conductor than copper. Its high thermal conductivity leads to applications such as radiators and cooking utensils. Its low density is important for hand tools and all forms of transportation, especially aircraft. Wrought aluminum alloys display a good combination of strength and ductility. Aluminum alloys are among the easiest of all metals to form and machine. The precipitation hardening alloys can be formed in a relatively soft state and then heat treated to much higher strength levels after forming operations are complete. In addition, aluminum and its alloys are not toxic and among the easiest to recycle of any of the structural materials.

Hardness measurements quantify the resistance of a cloth to plastic deformation. Indentation hardness tests compose the majority of processes used to determine material hardness, and should be divided into three classes: macro, micro and nanoindentation tests. Microindentation tests typically have forces but 2 N (0.45 lbf). Hardness, however, can't be considered to be a fundamental material property.[citation needed] Classical hardness testing usually creates variety which may be wont to provide a relative idea of fabric properties. As such, hardness can only offer a comparative idea of the material's resistance to plastic deformation since different hardness techniques have different scales.

The main sources of error with indentation tests are poor technique, poor calibration of the equipment, and therefore the strain hardening effect of the method . However, it's been experimentally determined through "strainless hardness tests" that the effect is minimal with smaller indentations.

Surface finish of the part and therefore the indenter don't have an impact on the hardness measurement, as long because the indentation is large compared to the surface roughness. This proves to be useful when measuring the hardness of practical surfaces. It is also helpful when leaving a shallow indentation, because a finely etched indenter leaves how easier to read indentation than a smooth indenter.

The indentation that's left after the indenter and cargo are removed is understood to "recover", or spring back slightly. This effect is properly known as shallowing. For spherical indenters the indentation is understood to remain symmetrical and spherical, but with a bigger radius. For very hard materials the radius are often 3 times as large because the indenter's radius. This effect is attributed to the discharge of elastic stresses. Because of this effect the diameter and depth of the indentation do contain errors. The error from the change in diameter is understood to be only a couple of percent, with the error for the depth being greater.

Aluminum has a density that is one-third the density of steel. Although aluminum alloys have lower tensile properties than steel, their specific strength (strength/density) is excellent. Aluminum is easily formed, has high thermal and electrical conductivity, and does not show a ductile-tobrittle transition at low temperatures. It is nontoxic and can be recycled with only approximately 5% of the energy needed to make it from alumina, which is why the recycling of aluminum is so successful. The beneficial physical properties of aluminum include its nonferromagnetic behavior and resistance to oxidation and corrosion. However, aluminum does not display a true endurance limit, so failure by fatigue may eventually occur, even at relatively low stresses. Because of its low melting temperature, aluminum does not perform well at elevated temperatures. Finally, aluminum has low hardness, leading to poor wear resistance. Aluminum responds readily to strengthening mechanisms; alloys may be 30 times stronger than pure aluminum. The attractiveness of aluminum is that it is a relatively low-cost, lightweight metal that can be heat treated to fairly high strength levels, and it is one of the most easily fabricated of the high-performance materials, which usually correlates directly with lower costs.

Biography:

Takahiko Nakaoki has completed his PhD from Osaka University (Japan) in 1992. He is Professror at Ryukoku University, Japan. He had been the director of The Society of Polymer Science, Kansai branch. He has published more than 60 papers in international journals.

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