Aerospace hydroxide-filled pu composite foams for improved

Aerospace andautomotive industryPolyurethane-based hinges, truss booms, coilabletruss booms, and storable tubular extendible member booms have been explored inaerospace 36. Considering the factors ofweight and shape recovery, and shape recovery, is expected to have greatpotential applications in aerospace 29. However, due to the extremely harsh space environment condition, such as verylow or high temperature, UV-light and high vacuum, PU foam based materials useto aerospace need more research and no doubt PU foam or their composite willplay increasingly important role in aerospace in the future. PU foams with adecrease in weight ratio as compared to traditional steel spring seat have beenwidely apply in automotive industry. On average, thirty pounds of flexible PUfoams are use in every vehicle such as seating, head, armrests, instrumentpanels and headliners 37. Dahlke et al.

38studied fiber-reinforced rigid PU foam system based on plant polyols. The foamswere used to construct interior trims for car. The plant polyols are goodadhesion on nature fibers. The parts can be used for car-door trims and sidetrims because of sufficient toughness and mechanical strength.

Mielewski et al 37 developedflexible polyurethane foam formulations containing functionalized soybean oilfor automotive applications. PU foams can be used as sound absorption material becauseof its high sound absorption efficiency in automobile industry for controlnoise, vibration, and harshness in car. Sung et al 39fabricated magnesium hydroxide-filled PU composite foams for improved acousticproperty. The result showed noise reduction coefficient was improved about 70%at the filler content of 1. 0 wt % with open porosity of 0. 63 compared with thenon-filler case. PUfoam sensorFlexible pressure sensors require highsensitivity in the low-pressure regime <0. 1 bar (10 KPa), fast response timein the millisecond range, and low power consumption and apply in future mobilesuch as rollable touch displays, biomonitoring and electronic skin.

Most ofthese applications 40. Schwartz et al. reportthe fabrication of flexible pressure-sensitive organic thin film thatcombination of a microstructured polydimethylsiloxane dielectric and thehigh-mobility semiconducting polyisoindigobithiophene-siloxane transistors witha maximum sensitivity of 8. 4 kPa-1, a fast response time of <10 ms, highstability over 415, 000 cycles and a lowpower consumption of <1mW. Vandeparre et al. 41 prepared PU foam-based based dielectric films and stretchablemetallic electrodes microfabricated capacitive sensors. The sensor displayedrobustness to extreme conditions including stretching and tissue-like foldingand autoclaving.

The author considered that the opencellular structure leads to increase of the capacitance upon compression of thedielectric membrane. The results showed that the sensor sensitivity can beadjusted with the foam density to detect normal pressure in the 1 kPa to 100kPa range. Liu et al. 42 producedlightweight conductive porous graphene/polyurethane (PU) foams (density of 110 kg/m3) to be used aspiezoresistive sensors.

The compression strength and modulus of the conductivefoams doped with 3 wt.% graphene was enhanced compared to the neat PU foam by about110% (from 9 to 21 kPa) and 185% (from 32 to 90 kPa), respectively. The authorssuggested that the addition of graphene (1, 2, 3 wt.%) led to thicker cell wallhindering the formation of small holes and leading to a robust porous structurewith excellent mechanical properties.