T3 TECHNION
TECHNOLOGY TRANSFER

Malat Building
Technion City, Haifa
3200003 Israel

T. 972.4.829.4851
www.t3.trdf.co.il

Shockwave protection layer

Prof. Yoav Eichen, Prof. Daniel Rittel, Dr. Galit Parvari, Dr. Yonatan Rotbaum
Faculty of Chemistry and Faculty of Mechanical Engineering, Technion- Israel Institute of Technology

- The Technology:
  - Unique inverse-freezing phenomena, in which fluids solidify upon heating. It was shown that upon impact, some of these inverse-freezing fluids undergo solidification by absorbing impact energy. This novel phase transformation, which occurs in timescales of microseconds, is in stark contrast to most materials which soften upon heating and lose some of their solid bonds upon impact. It was also demonstrated that upon shock-induced solidification, these systems dissipate the shockwaves and attenuate the incoming impact force.
  - Shock absorbing solutions are enhanced by compositing the inverse-freezing components with additives, producing synergic effects that amplify the shock attenuation. Composites of the systems show improved properties of hardening under dynamic loading and enhance the strain-rate sensitivity of our systems. Compositing has also showed a significant effect on the novel materials' uptake of energy.
- Advantages:
  - Shockwave attenuation across wide range of shock frequencies
  - Inexpensive, non-toxic, water based, high molecular weight materials
  - Long term stability
- Applications and Opportunities:
  - Traumatic organ injury protection
  - Building & packaging protection
  - Wearable gear
- Keywords: inverse freezing gel, composites, shock protection, wearable protection

T3 TECHNION
TECHNOLOGY TRANSFER

Malat Building
Technion City, Haifa
3200003 Israel

T. 972.4.829.4851
www.t3.trdf.co.il

Figure 1. A comparison between the crater depths, caused by the shockwaves of a stopped FN MAG bullet, between an armor layer without a anti-trauma element (left) and an inverse-freezing anti trauma element (right). The measured depths are 66 mm and 41 mm respectively.