

**Elastic & Inelastic Balls**  
**(“Happy” and “Unhappy” Balls) (Set of 10 pairs)**  
**P70-3840-W0**

The Inelastic “Unhappy Ball” is made of rubber called Norbornene polymer (brand name: Norsorex) which possesses excellent impact absorption properties. The rubber has great internal absorption of inputted energy and is able to dampen impact from a colliding object without giving the object a reaction force.

It has the advantage whereby little resonance can be caused to occur by external vibrations. It can be processed in a similar manner to that of ordinary rubber, and sheets made of this material are utilized in a lot of applications. The Elastic “Happy Ball“ is made of common neoprene.

**Specifications:**

Inelastic “Unhappy Ball“: size  $\phi$  25mm, weight 10g

Elastic “Happy Ball“: size  $\phi$  25mm, weight 8g

**Characteristics:**

1. Low restitution elasticity (less than 10%)
2. It has especially good energy absorption under normal temperature ranges (10 - 30°C)
3. Its absorption and insulation of high frequency vibrations are especially good.

**Range of use:**

1. As damping material
  - for protection of conveyor mechanism, stoppers for precise location of articles conveyed, and shock absorbers (in place of pneumatic and hydraulic types).
2. Padding materials
  - for the prevention of things dropped from being scattered and for the reduction of fatigue on legs and loins.
3. Material for minimizing resonance on audio equipment
  - Prevention of speaker howl. Insulation of external vibration to player units.
4. Low hardness rubber roll material
  - Rolls for printing.
5. Footwear sole material
  - for the reduction of heel strike.

6. Industrial use
  - gaskets and packing.
7. Sports goods
  - Globes, mats, and supporters.

**Comparison of mechanical properties:**

Item	Neoprene (Happy Ball)	Norsolex (Unhappy Ball)
Tensile strength (kg f/cm <sup>2</sup> )	205	124
Stretch (%)	370	550
Hardness (JIS A)	63	32
Restitution elasticity (%)	53	3
Compression permanent set (70°C × 22H%)	15	48
Specific gravity	1.39	1.25

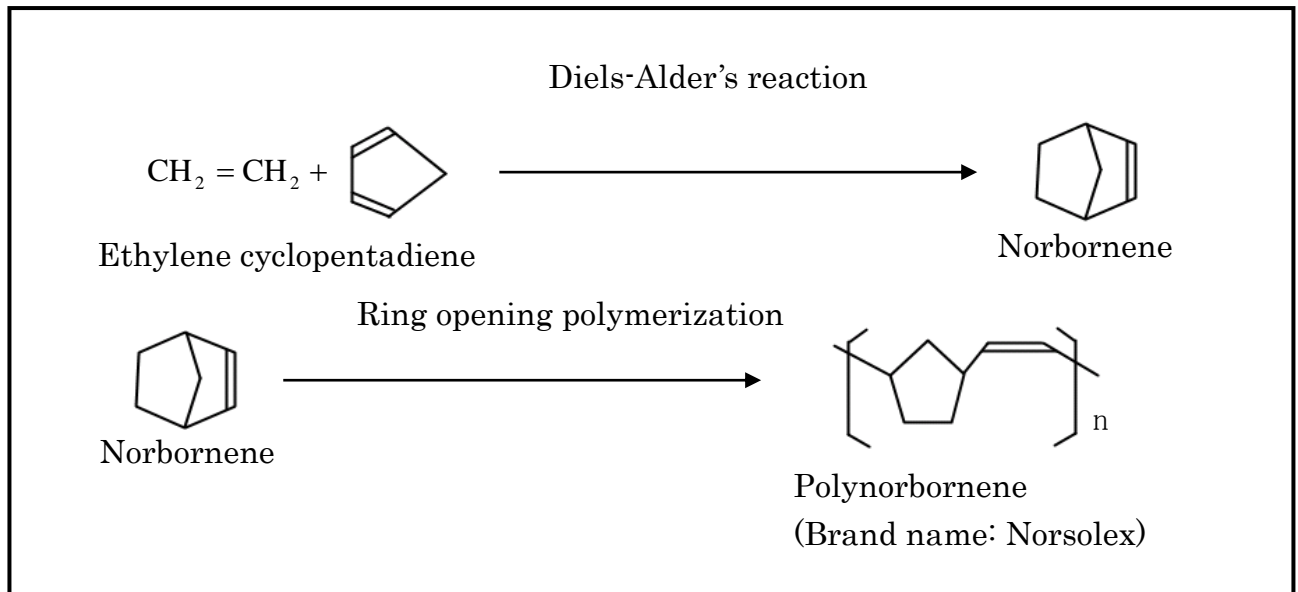
**Example of Experiments:**

Drop “Happy Ball” and “Unhappy Ball” to the floor from certain height and observe how the balls bounce differently. It is better if the floor is concrete or other hard material in comparison to wooden or plastic floor, because in case of wooden or plastic floor the floor itself can bounce a little bit and affect the bounce effect. If the balls are cold, for example in winter, they might not bounce as they should, therefore please warm them with your hands.

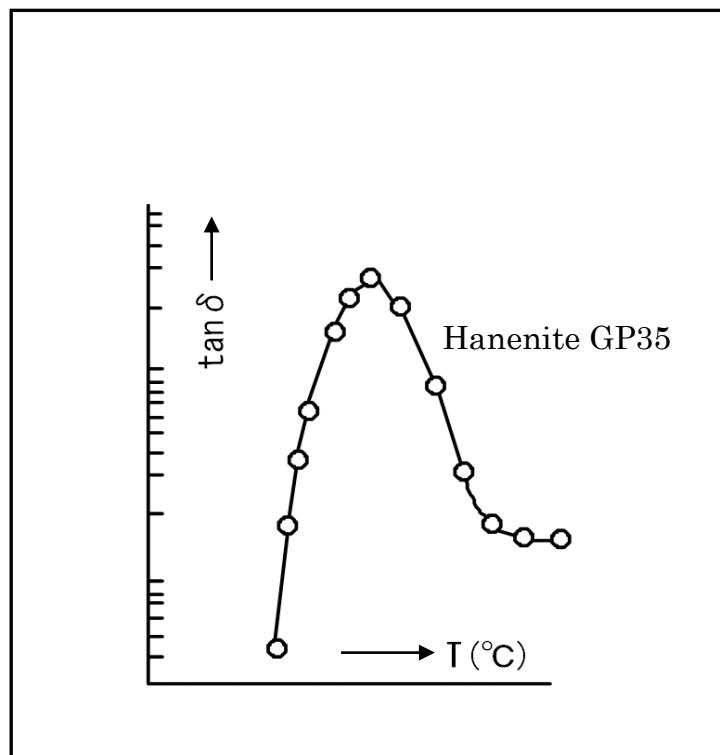
**Manufacturing method for Norsolex:**

As shown in the diagram 1 below, Norsolex is obtained through the synthesis of Norbornene from Ethylene cyclopentadiene by the Diels-Alder’s reaction, then through ring opening polymerization of the Norbornene monomer. Norsolex is a polymer which has a construction whereby double bonding and the five membered ring have been bonded alternately, which means that vulcanization can be by utilizing this double bonding.

Diagram 1



Energy Absorption of Norsolex versus Temperature ( $\tan \delta$ )



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