Cryogenic Recycling of Solid Trash

Cryogenic recycling and processing
Norman R. Braton

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Recycle Symbol

Breaking up of waste
Pulverization depends on Type of Material

Metals
Ceramics
Polymers

Face Centered cubic
Body Centered cubic
Hexagonal close packed
Others

Organic
Inorganic

Synthetic
Natural

Temperature Effect on Failure Rate

Strain Rate:
How fast can you change
the shape of an object
without it breaking.

This decreases for most
materials as T decreases.

Temperature, °C

Maximum Stress
PMMA
Zinc
PVC

Straining Rate, sec⁻¹

-100
-50
0
50
100
150
200

10⁻⁴
10⁻²
1
10²
10⁴

You just observed that failure rate decreases with temperature. What happens, in general, to the strength of materials as T is lowered?

A. Increases
B. Decreases

Embrittlement

Material with no Embrittlement
Transition—Ductile

Strength

Material with Embrittlement
Transition—most common in
BCC metals—ships

Polymers

Thermo-plastic
Van der Waals Forces

Thermoset
Covalent Bonds

Elastomer
Cross-linked (both Van der Waals Forces and Covalent Bonds)
Changing Polymer Bonding
Heat Treatment

Example: Tire Component reclamation
- One tire thrown away every year for every American
- Uses 3 cubic feet of land fill
- Not bio-degradable
- Breath-Pop to surface
- 8 gallons oil to make one tire
- Yet contains valuable components

Tire Processing Plant

Cooling times for Tires
- Immersed in LN2 for 30 sec, then removed.

Interpreting the previous graph:
A. 30 seconds is long enough for a tire to reach thermal equilibrium in LN2
B. 90 seconds is long enough for a tire to reach thermal equilibrium after being in LN2 for 30 sec
C. A much longer time than 90 seconds is needed for the tire to reach equilibrium in LN2
D. None of the above statements are true

Cryogenic Grinding
- Increased throughput and productivity
- No product caking in mill or on other equipment
- Inert atmosphere provides protection against explosion and oxidation
- Low level of wear and tear (grinding equipment)
- Heat-sensitive products (e.g. spices, pharmaceutical products, thermoplastics) are not affected
DUE TO THE PEAK INTEREST IN GREEN TECHNOLOGY, WE ARE EXPERIENCING A HIGH VOLUME OF INQUIRIES. PLEASE BE PATIENT AS WE INSIST ON GIVING EACH INQUIRY A PROPER RESPONSE. Please read our FAQ (Frequently Asked Questions) before contacting us. We are in the Eastern Time Zone. We are proud to announce new recycled tire materials of CryoMulch TM AlternaMulch TM ExtendaMulch TM AlternaPave tm) AlternaPave tm) AlternaPave TM AlternaMat tm) CryoInfill TM CryoPlay TM and CryoTurf TM. These materials are produced by the CryoVortex and have unique advantages and properties.

http://www.scraptiresusa.com/CryoVortex_Sales_07.pdf
Cryogenic Grinding Particle Size

Comparison of the specific costs, calculated for 0.66MM lbs/yr throughput, covering only the usable product.

Material Separation

New products

2x10^9 kg/yr of tires produced
10 cents/kg to process
5% used to asphalt roads
10-12% for tracks, RR crossings, tennis courts
12% burned in coal fires for power and cement plants—reduces mercury pollution

New products

Process works on many things

Auto Generator Plastic packaging

Metal Recycling(4495)
Plastic Recycling(6013)
Tire&Rubber Recycling(478)
Textile&Leather Recycling(1429)
Paper Recycling(1325)
Electronic&Computer Recycling(583)
Glass&Wood Recycling(105)
Dry Ice Blasting

- CO₂ sublimation
  - No extra pollution
  - Elimination of the gaseous CO₂ by vacuum or evaporation

- Thermic shock
- Low mechanical shock
- Disconnection of the pollution
- Respect of the surface

No waste abrasive to recycle!