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Non-Confidential Description - PSU No. 3215
"Treatment of Glass Spheres for Application as Proppants"

Keywords:
hydrofracturing, proppants, hydrofracing, glass spheres

Links:

Inventor website
US Patent 8,193,128

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Fig 1: Proppants of the invention fail into larger fragments retaining significant propping abilities.

Background

In the hydrofracturing process for stimulating oil/gas well production, a slurry of surfactants, acids, and solid particles is pumped into the well, intended to selectively open, clean and prop open geological fractures. These particulates, commonly referred to as proppants, must remain in the appropriate location after the release of the fracturing pressure. Therefore, they must provide a strong, reliable, and permeable bed. The hydrofracturing industry continually seeks stronger, lower specific weight and cheaper alternatives to enhance the efficiency and lower the costs of stimulating oil/gas wells. Key characteristics of effective proppants include: high strength and high degree of sphericity to promote flow and dispersion in the fracing pad; low specific gravity to mitigate settling during placement; and highly reliable failure behavior to promote maximum well permeability.

Invention Description

The disclosed invention details a process using molten salt ion exchange to process silica-based glass spheres, altering the residual stress state and flaw population. This process tailors the mechanical properties, failure mechanisms and the resultant fragment morphologies for enhanced service performance. The spheres are to be used primarily as proppants in hydrofractured oil and natural gas wells. The process outlined here mitigates the propensity of conventional glass spheres to fail energetically and catastrophically into fine particulates under multiaxial compressive loading, thereby resulting in enhanced permeability and extraction efficiency in packed proppant beds.

Advantages / Applications

- Produces proppants analogous to existing materials using substantially cheaper raw materials and processing routes – recycled glass cullet, for example, might be used
- Deviates from the typical high-energy failure of amorphous glass, meaning particles may fail without blinding the packed bed of proppants
- Heat treatments involve lower temperature and shorter times than current energy-intensive solutions

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