MECHANICALLY-GASSED EMULSION EXPLOSIVES AND METHODS RELATED THERETO

TECHNICAL FIELD

[0001] The present disclosure relates generally to the field of explosive compositions. More particularly, the present disclosure relates to mechanically-gassed emulsion explosives and methods related thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] The written disclosure herein describes illustrative embodiments that are non-limiting and non-exhaustive. Reference is made to certain of such illustrative embodiments that are depicted in the figures, in which:

[0003] FIG. 1 is a schematic diagram illustrating one embodiment of a process flow for manufacturing mechanically-gassed emulsion explosive.

[0004] FIG. 2 is another schematic diagram illustrating another embodiment of a process flow for manufacturing a mechanically-gassed emulsion explosive.

SUMMARY

[0004A] In a first aspect of the present disclosure, there is provided a method of delivering an emulsion explosive, the method comprising:

obtaining an emulsion matrix comprising a discontinuous phase of oxidizer salt solution droplets in a continuous phase of a fuel, wherein the emulsion matrix has an initial viscosity of about 4,000 cP to about 20,000 cP;

mechanically introducing gas bubbles into the emulsion matrix to sensitize the emulsion matrix and form an emulsion explosive; and

homogenizing the emulsion explosive to form a homogenized emulsion explosive with a viscosity of greater than or equal to 80,000 cP and that is devoid of an additive that stabilizes gas bubbles.

[0004B] In a second aspect of the present disclosure, there is provided a method of delivering an emulsion explosive, the method comprising:

splitting an oxidizer salt solution into a first portion and a second portion;

mixing the first portion of the oxidizer salt solution with a fuel to form a low viscosity fuel-rich emulsion matrix, wherein the fuel is substantially devoid of an additive that stabilizes gas bubbles;

mechanically introducing gas bubbles into the preliminary emulsion matrix to sensitize the fuel-rich emulsion matrix and form a fuel-rich emulsion explosive;

mixing the second portion of the oxidizer salt solution into the fuel-rich emulsion explosive to form a more-balanced emulsion explosive with increased viscosity; and

homogenizing the more-balanced emulsion explosive to form a homogenized emulsion explosive with further increased viscosity.

[0004C] In a third aspect of the present disclosure, there is provided a homogenized emulsion explosive made by the method of the first or second aspect.

DETAILED DESCRIPTION

[0005] This disclosure generally relates to water-in-oil (or melt-in-oil) emulsions for use as explosives, along with related methods. The term "water-in-oil" means a dispersion of droplets of an aqueous solution or water-miscible melt (the discontinuous phase) in an oil or water-immiscible organic substance (the continuous phase). The water-in-oil emulsion explosives of this invention contain a water-immiscible organic fuel as the continuous phase and an emulsified inorganic oxidizer salt solution or melt as the discontinuous phase. (The terms "solution" or "melt" hereafter shall be used interchangeably.)

[0006] Emulsion explosives are commonly used in the mining, quarrying, and excavation industries for breaking rocks and ore. Generally, a hole, referred to as a "blasthole" or "borehole," is drilled in a surface, such as the ground. Emulsion explosives may then be pumped or augered into the blasthole. Emulsion explosives are generally transported to a job site or made on the job site as an emulsion that is too dense to completely detonate, referred to as an emulsion matrix. The emulsion matrix is not considered an explosive. In general, the emulsion matrix needs to be "sensitized" in order for the emulsion matrix to detonate successfully. A sensitized emulsion matrix is considered an emulsion explosive.

[0007] Sensitizing is often accomplished by introducing small voids into the emulsion matrix. These voids act as hot spots for propagating detonation. These voids may be introduced by injecting a gas into the emulsion and thereby forming discrete gas bubbles, adding microspheres, other porous media, and/or injecting chemical gassing agents to react in the emulsion and thereby form discrete gas bubbles.