Explosion dust particle size measurements

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Applied Optics, Vol. 22, Issue 1, pp. 95-102 (1983) doi:10.1364/AO.22.000095

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Citation
R. G. Pinnick, G. Fernandez, and B. D. Hinds, "Explosion dust particle size measurements," Appl. Opt. **22**, 95-102 (1983)
http://www.opticsinfobase.org/abstract.cfm?URI=ao-22-1-95

Abstract

In situ measurements of the sizes and concentrations of dust particles generated by the detonation of high explosives in clay soil near Leesville, La., sandy clay soil near Huntsville, Ala., and sandy soils near Orogrande, N.M. are reported. Measurements were generally made within 1 m of the surface (in one case 10 m) at distances ranging from 10 to ~50 m from the detonation point with a combination of Knollenberg light-scattering counters (for particles with equivalent radius in the submicron to 15-μm range) and a Knollenberg optical array probe (for particles of 10–150 μm). Measurements were made for periods of several tens of seconds following detonation. All dust size distributions, irrespective of soil or explosive type, exhibit a bimodal character with mass mean radii of ~7 and 70 μm. Peak aerosol mass loadings inferred from the distributions have values ranging from 0.05 to 10 g gm^{-3} with the larger mode of particles contributing most to the mass loading. Predictions of dust extinction coefficients at visible (0.55-μm) and IR (10.4-μm) wavelengths were made using the measured size distributions together with estimates of dust refractive indices. These predictions suggest that extinction should be nearly neutral (wavelength independent) in agreement with transmission measurements made during some of the tests. Predicted mass extinction coefficients, under the assumption of dust material density of 2.5 g cm^{-3}, are of the order of 0.05 m^2 g^{-1} at both visible and IR wavelengths. This value is also in good agreement with a test-averaged measured value of 0.03 m^3 g^{-1} (at $\lambda = 10.6$ μm) obtained using a short path transmissometer and hi-vol sampler.

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