Transient Vacuum and High Pressure Generation By Focused Acoustic Waves

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Abstract

Amplitude of acoustic waves can be magnified by conical or concave waveguides, like in ear trumpets or fjords (surface waves). The simplest way realizing a capable device is a conical waveguide with a target to be treated in the top of the cone, and a spherical actor or acoustic exciter on the other end. The acoustic amplitude is magnified, respectively compressed by the ratio of the local cross section of the waveguide. The amplitude magnification can be approximately estimated by the conservation of pressure and wave energy. This can induce very low (vacuum) or very high pressures and temperatures in the acoustic focus. The simulations were performed with COMSOL Multiphysics® using the Pressure Acoustics, Frequency Domain (acpr) interface and the Wave Equation (waeq) interface (for transient modeling).

Commercial use of this technology can improve or provide pseudo-continuous low-pressure plasma applications, like Plasma Chemical Vapor Deposition (PCVD) or high-presssure-high-temperature applications like surface recrystallization or transformation of element's modifications (i.e. graphite - diamond). High-pressure and high temperature shockwaves also can induce fast non-equilibrium chemical reactions. Many other applications are possible.

References:
German patent, Optima pharma (Patent pending) : DE 10 2013 204 353 A1 ; 2014.09.18

Figures used in the abstract

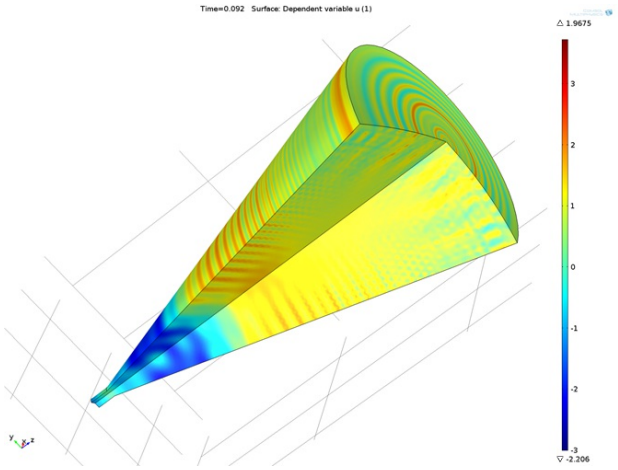

Figure 1: Acoustic vacuum by focused waves.