

# **The Effect of Static Magnetic Field on Thermo-Acoustic Radiation Using Free-standing Nano-Thin Films**

Yida Mao<sup>†‡</sup>, C.W. Lim<sup>‡</sup> and Tianyun Li<sup>†</sup>

<sup>†</sup>School of Naval Architecture and Ocean Engineering, Huazhong University of Science and Technology, Wuhan, Hubei 430074, P.R. China

<sup>‡</sup>Department of Architecture and Civil Engineering, City University of Hong Kong, Kowloon, Hong Kong SAR, P.R. China, and City University of Hong Kong Shenzhen Research Institute, Shenzhen 518057, P.R. China

## **Abstract**

Thermo-acoustic radiation from nano-thin film has been widely reported these years. In this paper, a static magnetic field is introduced to enhance the acoustic power in the multi-field thermo-acoustic generation. The coupled thermo-acoustic system in a static magnetic field shares the same acoustical unit with very few additional components. In the presence of a static magnetic field, thin-film vibration is excited instead of being still in the classical thermo-acoustic system. Not surprisingly, a steady magnetic field has very little impact on the thermo-acoustic generation system when a constant amplitude sinusoidal current is introduced. The oscillation perpendicular to the nano-thin film is driven by the electromagnetic force. The system response of thermo-acoustics and magneto-acoustics can be generally matched when suitable parameters are introduced. The acoustical pressure output can be significantly improved in the presence of a static magnetic field although more electrical input power should be provided in the multi-field thermo-acoustic system. Evidently, the coupled multi-field acoustical system is able to handle more electrical power input and the power input can be more easily dissipated relatively. The results show that the acoustic response of this new multi-filed coupled system can be significantly improved comparing to the classical system without magnetic effects.