Microscale Ion-Driven Air Flow

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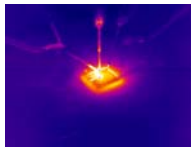
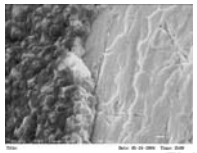
Objective

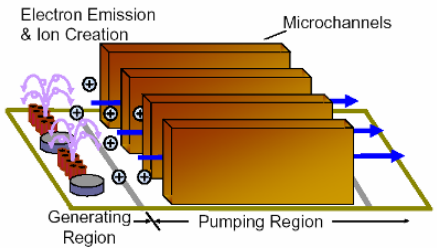
Utilize travelling wave electrohydrodynamics to develop a novel microscale ion-driven air pump for providing high heat flux air cooling solutions to the microelectronics industry

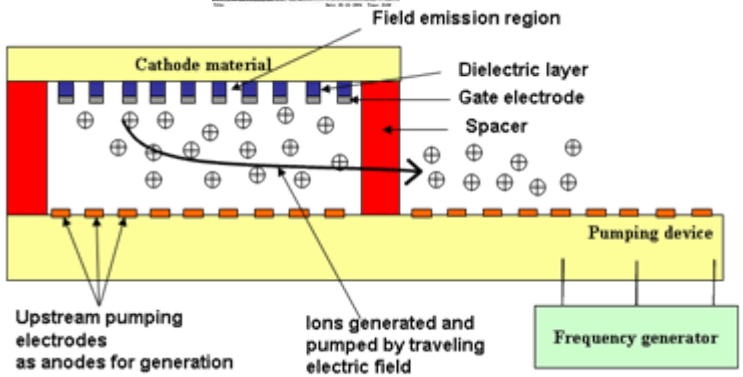


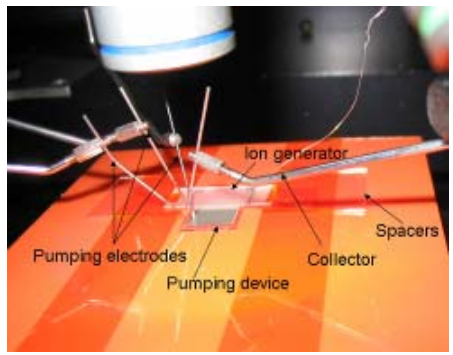


Advantages

- Extends limits of air-cooling heat dissipation capacity
- Noiseless, low power consumption
- Provides air cooling-based chip-integrated thermal management solutions



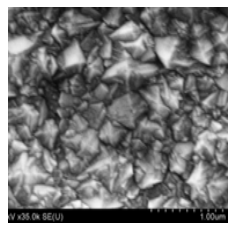


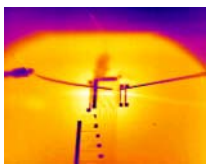


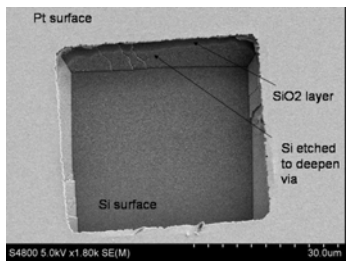
Approaches

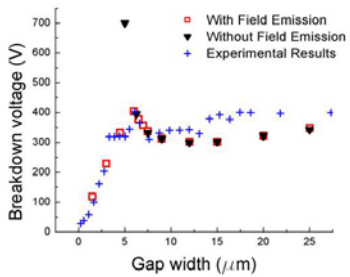
- Unipolar ion generation from atmospheric air using field emission
- Characterization of field emission from nanomaterials
- Monte-Carlo simulation to predict ionization of atmospheric air
- Air pumping by ion drag using a three-phase traveling electric field to move ions
- Multiphysics, multiscale modeling to predict flow and heat transfer

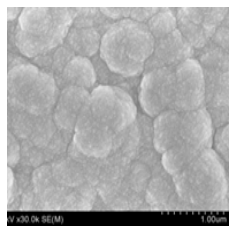
Sponsors: NSF, SRC











Publications

- Zhang, W., Fisher, T. S., and Garimella, S.V., *J. App. Phys.*, **96**:6066-6072, 2004
- Schlitz, D. J., Garimella, S.V. and Fisher, T.S., IMECE2003-41316, 2003
- Peterson, M.S. Zhang, W. , Fisher, T.S. and Garimella, S.V., *Plasma Sources Science and Technology* **14**:654-660, 2005.

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