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12-5-2022

Liquid Sandbox for Rapidly Optimizing the Thermal Management of High-Power Wireless Charging Systems

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Recommended Citation

Sabin, Conner, "Liquid Sandbox for Rapidly Optimizing the Thermal Management of High-Power Wireless Charging Systems" (2022). *Fall Student Research Symposium 2022*. 51.

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Wirelessly charging electric vehicles

Wireless charging systems are currently being implemented for electric vehicles. The transmitter coil is put in the concrete or asphalt roadway and the receiver coils are put on the bottom of the electric vehicle.

The electric vehicle receives charge as it is parked on top of or drives over the wireless charging pad in the roadway.



Simulated image of car being charged as it drives. Blue glow added for emphasis to show transmitter coil

Current testing methods are expensive and time consuming

In order to prototype systems, they are usually tested in concrete to ensure they will function correctly without overheating.

We want to test them in something cheaper and faster that will still give us similar thermal results.

Liquid sandbox can help test the thermal properties of electric vehicle wireless charging systems



Liquid sandbox used for testing the thermal properties of wireless charging systems. Bubbling is visible in the middle of the sandbox where the sand is acting as a liquid.

Liquid sandboxes may provide a cheaper and faster solution

The process of liquidizing a solid is used widely in industry for things like power coat painting, grain silos, and medicine.

We can pass air through small particles like glass beads, grain, or sand particles to make the particles act as a liquid.

Wireless charging systems can be inserted and removed from a liquid sandbox with ease for rapid testing.

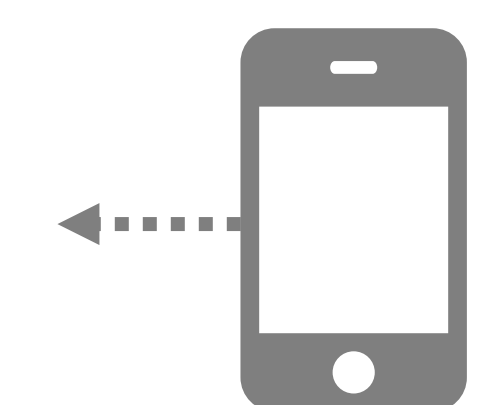


PVC pipe grid has 2000 small holes that allow air to leak out and flow upward through the sandbox creating liquidization

Simulating sand experiments

After testing systems in the liquid sandbox, we can simulate test conditions in a tool called ANSYS.

We can then modify the simulations until we have a model that mimics concrete tests without wasting the time and material on physical experiments.



Take a picture to see liquid sand hot tub