

iMAPS 2025 Title and Abstract, Piezo Energy Technologies, LLC

Ultrasound Wireless Power Transfer (UWPT) effectiveness in the frequency, transmitter-receiver dimensional domains; Inder Raj S. Makin,^(1,2) Paul Jaeger,⁽¹⁾ Harry Jabs,⁽¹⁾ T. Douglas Mast,⁽³⁾ Priyanka Makin,⁽¹⁾ Leon J. Radziemski.⁽¹⁾

⁽¹⁾ Piezo Energy Technologies, LLC, Mesa, AZ, United States; ⁽²⁾ School of Osteopathic Medicine, A.T. Still University of Health Sciences, Mesa, AZ, United States; ⁽³⁾ University of Cincinnati, OH, United States

With an ever-increasing use of active and passive implantable systems within the body, there is a concomitant need to better manage the size and form factor of such devices. Possibly the largest component within an implant is the powering source – a primary or a secondary (rechargeable) battery. The rechargeable powering approach helps keep the device size small, however, an optimal means of wireless powering needs to be implemented. Currently known methods of wireless powering use electromagnetic (inductive or capacitive) fields. An alternative means for wireless energy transfer uses ultrasound, whereby an ultrasound receiver integrated within the implant, converts the transmitted sound field to direct battery-charging energy, following rectification. Rather than making a direct comparison of power transfer for various modalities, it is more relevant to focus on transmit-receive form factors, useful powering efficiency available at various depths, mode of integration within implant, and capability to follow powering protocols determined by specific applications. The use-case requirements convert to the determining the transmit-receive transducer dimensions, operating ultrasound frequencies, and bonding to specific implant enclosure, such as titanium, as well as coupling of transmitter to skin tissue. This talk will present results from test-studies using ultrasound transducers at set frequencies and dimensions, with the receiver bonded to a titanium shell, or coupled directly to the propagating medium such as water or tissue. Various considerations to predict increase in tissue temperature increase from ultrasound energy absorption will be presented.

Inder Raj Makin, MD, PhD, is Chief Technology Officer of Piezo Energy Technologies, LLC, an ultrasound-based wireless powering solutions company (UWP). Dr. Makin is a scientist-innovator in the area of medical instrumentation and ultrasound, having published >35 peer-reviewed publications and book chapters and ~70 issued patents. He was Principal Scientist at J&J Ethicon Endo-Surgery, and co-founder of Ulthera, Xthetix, and Guided Therapy Systems. Dr. Makin is currently a tenured Professor at A.T. Still University, AZ, working in diverse areas of device development, medical ultrasound research as well as teaching and training medical physicians.



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Inder Raj S. Makin^{1,2}, Paul Jaeger¹, Harry Jabs¹, T. Douglas Mast³, Priyanka Makin¹, Leon Radziemski¹

¹Piezo Energy Technologies, Mesa, AZ,

²A.T. Still University, Mesa, AZ,

³University of Cincinnati, OH

Inder Makin: inder.makin@gmail.com

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Further Details

- Ultrasound Wireless Power Transfer (UWPT) effectiveness in the frequency, transmitter-receiver dimensional domains. Inder Raj S. Makin, iMAPS 2025, Phoenix, AZ
<https://imaps.org/page/Medical2025>
- Delivering wireless ultrasound energy to remote systems: Design implications for powering medical implants requiring milliwatt versus several watts of power. Inder Raj S. Makin, Acoustics 2023, Sydney
https://acousticalsociety.org/wp-content/uploads/2023/04/Sydney_program.pdf
- Tech Note: “Fast-charging of micro-batteries using directive ultrasound;” 2023 www.gopiezo.com
www.ilika.com
- Popular Interest Article: “Charging devices inside the body or outside: Ultrasound Wireless Powering offers several possibilities;” 2022 <https://acoustics.org/4pba8-charging-devices-inside-the-body-or-outside-ultrasound-wireless->
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- “In vivo demonstration of ultrasound power delivery to charge implanted medical devices via acute and survival porcine studies;” 2016 Ultrasonics
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