From Ultrasonic Cleaning to Sonochemistry

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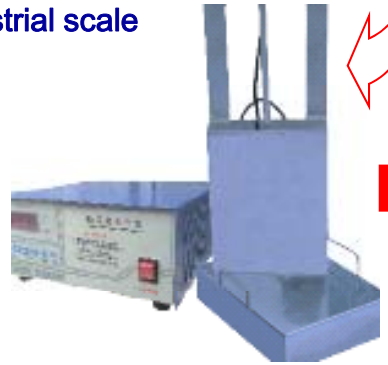
Small cleaning

Industrial scale

Transducers

Lab processing



Throw-in-type
cleaning or processing

Industrial sonochemistry

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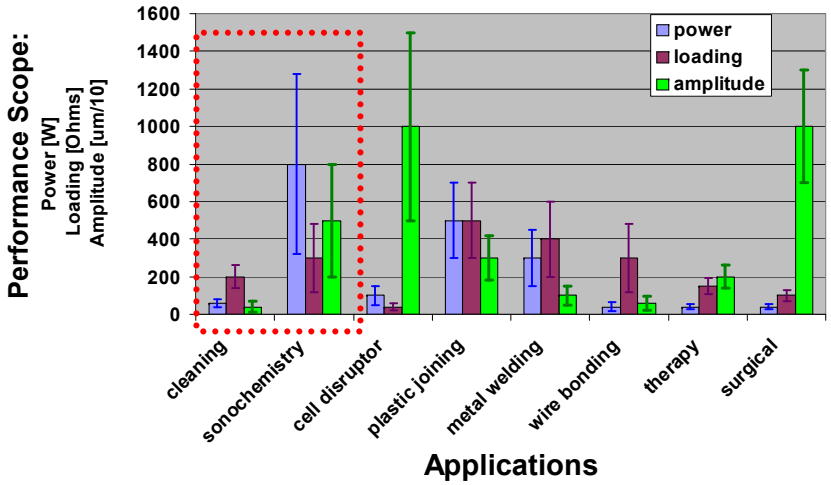
Difference Between Ultrasonic Cleaning and Sonochemistry



Ultrasonic cleaning transducer characteristics:

- Less critical areas: Thermal, mechanical, electrical, size
- Area to improve: efficiency, bandwidth
- Areas to look: Increase loading, optimize structure, large radiation surface, position of drive source.

Sonochemistry transducer characteristics:

- High amplitude, large radiation surface, heavy load, high power
- High gain, increase the radiation surface, large driving source, multi-stack drive elements, mode conversion – longitudinal to radial, to strip transverse

Cleaning transducers

Sonochemistry transducers and the increased radiation surface

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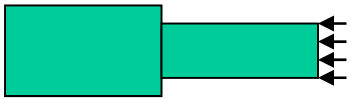
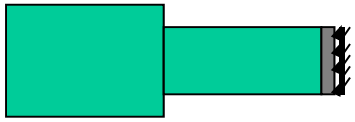
Efficiency Improvement From Ultrasonic Cleaning to Sonochmistry

Simplified loading model for FEA optimization



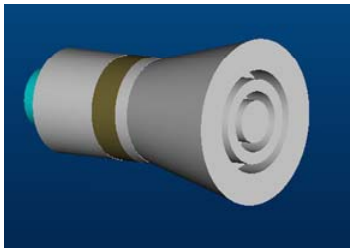
Resistance component:
simulate by opposite force, monitor by the amplitude drop

Variable: *F/S (N/mm^2)*
Efficiency = $1-V_{load}/V_0$
F: force, *V* – velocity, *S* - area

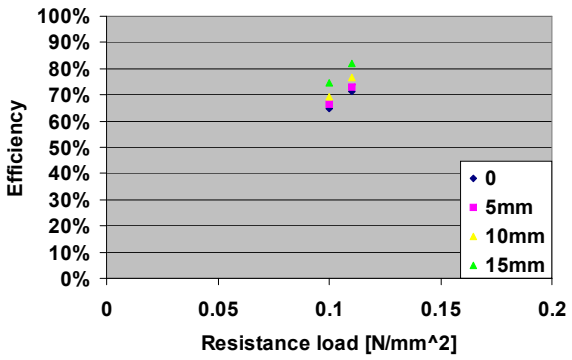


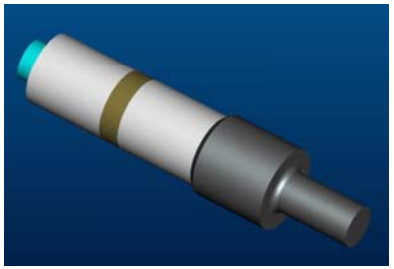
Reactance component:
simulate by constrained mass, monitor by the frequency shift

Variable: *E (Gpa) in the constrained mass*
Efficiency = $V_{load}{}^{*}V_0{}^{PZT}/(V_0{}^{*}V_{load}{}^{PZT})$
E: Elastic Modulus, *V* – velocity

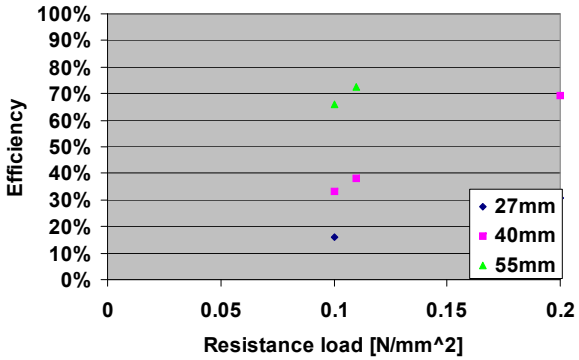


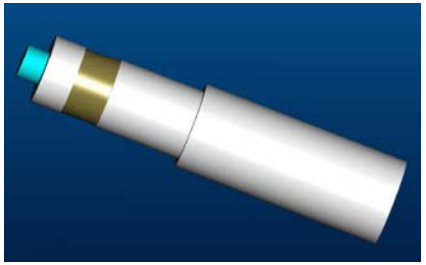
Effect of the slot depth



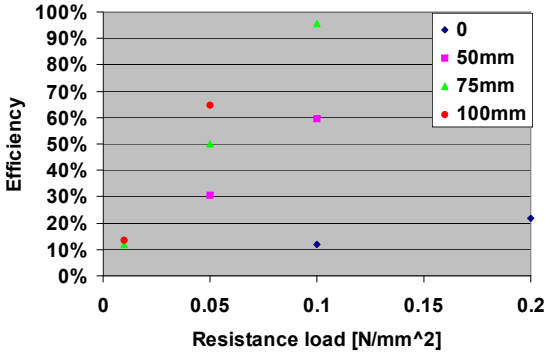


- of the back diameter





- of the radiator length



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Improved Power Of Single Transducer Used In Sonochemistry

Ultrasonic cleaning transducers

Type	Length (mm)	Weigh (g)	Frequency (KHz)	Resonance Impedance (Ω)	Static Capacity (pF)±10%	Input Power (W)
CCH-6845D-20LA PZT-8	95	910	20	20-40	5000	100
CCH-6845D-28LB PZT-4	66	624	28	10-25	6600	100
CCH-5838D-25LB PZT-4	76	524	25	10-25	5400	60
CCH-6845D-30L PZT-8	61	550	30	10-25	5000	100
CCH-4838D-33LA PZT-8	58	420	33	10-25	3800	60
CCH-4838D-40ZB PZT-8	56	310	40	10-25	3800	60

Tubular transducers used in sonochemistry

Tubular Equipment Type	Tubular Transducer Type	Frequency (KHz)	Input Power (W)	Length (mm)	Diameter (mm)	Static Capacity (pF±10%)
TB26-5	TB26-45L2-458	25-27	1000	458	Φ73	68000
TB26-4	TB26-45L2-624	25-27	1100	624	Φ73	68000
TB26-3	TB26-45L2-790	25-27	1200	790	Φ73	68000
TB26-2	TB26-45L2-957	25-27	1300	957	Φ73	68000
TB26-1	TB26-45L2-1123	25-27	1500	1123	Φ73	68000
TB26-5-2	TB26-45L4-910	25-27	2000	910	Φ73	132000