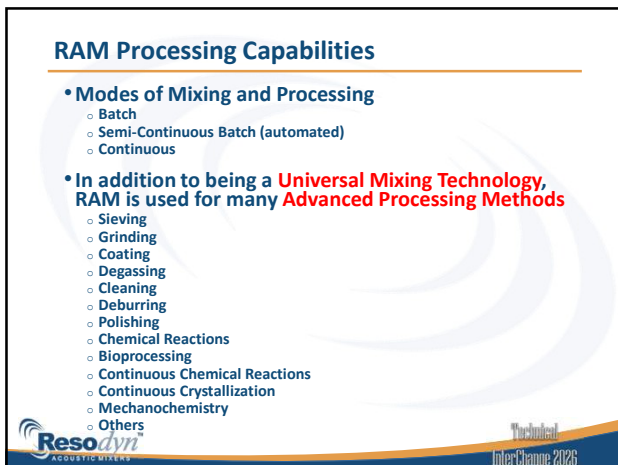




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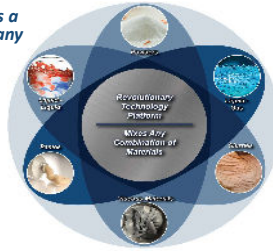


3

ResonantAcoustic® Technology

Acoustic Resonator Technology Platform Uniquely Enables

- Versatility and Flexibility as a **Universal Platform** to mix any Combination of Materials
- Use Over a Broad Range of Industrial Applications
- New Product Discovery
- Rapid Product Evolution
- Seamless Scalability from Bench-to-Production-to-Continuous

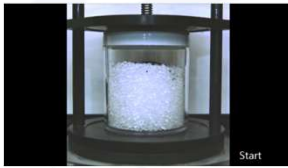


4

Highlighted
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4

Example Mixing/Processing Regimes



High-Speed Video of sub-millimeter Beads of micron sized Carbon Black being milled/mixed and coating millimeter sized polymer beads – 4 seconds duration



Top View
Realtime Video of 3-million cP viscous paste Being mixed in RAM55 system



Highlighted
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5

Resodyn Acoustic Mixer as a Universal Mixing and Processing Platform

- The RAM Technology **Employs a Single Platform** to Mix and/or Process a Broad Range of Materials **Harness the power of a smart platform**
- The Underlying Foundation for the RAM Technology is the Use of an **Oscillating Resonant Driver System** to Transfer Energy to a Platform that Shakes a Mix Vessel, or Processing Container 
- The Resodyn Acoustic Mixing (RAM) and Processing Technology is **Arguably the Most Universal Mixing/Processing Technology** of any Type Developed to Date 



Highlighted
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ResonantAcoustic® Technology Core Features

- The ResonantAcoustic® Mixing and Processing Technology has one Common Element -- “Resonator”
- The ResonantAcoustic® Technology Embodies 3 Core Features
 1. Sound Energy Generator
 2. Operates at Large Displacements and at Modest Frequencies
 3. Operates at Mechanical Resonance
- ResonantAcoustic® Mixing and Processing Technology Requires one to  Mindsets on Several Fronts

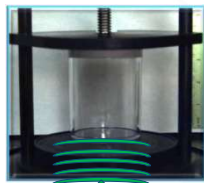


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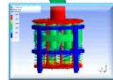
ResonantAcoustic® Technology Core Feature Number 1 -- Vibration Generator

A Sub-Woofer is an acoustic energy generator designed to produce low-frequency sounds by vibrating



Empty container at 100 g of acceleration 3,600 fps

VIBRATION ENERGY

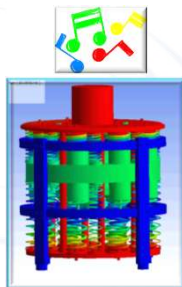


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The “Driver” Applied for all RAM Phenomena All Systems Use the Same Vibrating Platform Concept

ResonantAcoustic® Platform

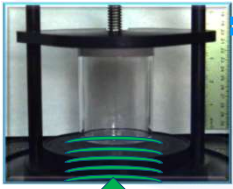


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ResonantAcoustic® Technology Core Feature Number 2 Operates at Substantial Displacements

ResonantAcoustic® Mixers Create Up to 0.55 Inch Oscillating Displacements at ~60 Hz and at 100 g of Acceleration



0.55 inch Peak-to-Peak Displacement at 100 g

Empty container at 100 g of acceleration 3,600 fps

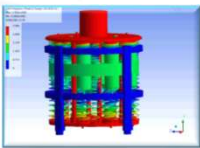
VIBRATION ENERGY

Resodyn
ACOUSTIC MIXERS

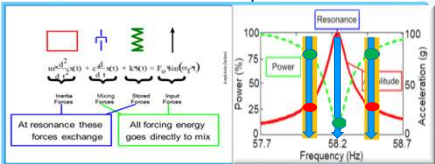
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ResonantAcoustic® Technology Core Feature Number 3 — Operates Mechanical Resonance

Resonator Platform and Dynamics



At resonance these forces exchange

All forcing energy goes directly to mix

Maximum Resonator Amplitude at Minimum Power

Resodyn
ACOUSTIC MIXERS

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Attributes of 3-Core Features

- These 3 Core Features are the **Basic Building Blocks** for each ResonantAcoustic® Platform
 - Bench Scale
 - Pilot Scale
 - Industrial Scale
 - Continuous
- These 3 Core Features **Enable Seamless Scalability** from
 - Bench Batch through Industrial Batch
 - Batch to Continuous
 - Bench Continuous through Industrial Continuous
- These 3 Core Features **Enable Multiple Processes** -- Mixing, Chemical Reactions, Crystallization, Milling, Coating, Sieving, etc., all on the Same ResonantAcoustic® Platform




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ACOUSTIC MIXERS

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ResonantAcoustic® Technology Enabling Operational Features

Not a Paint Shaker, nor an Ultrasonic Technology
Modest Frequency and Substantial displacements

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Resodyn is Neither Lying nor Crazy -- Just Still Discovering

"Anyone who claims to understand quantum theory is either lying or crazy."

ResonantAcoustic® Mixing

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Take Home Messages

- Headway in the Understanding of ResonantAcoustic® Mixing Process is Continuously being made by Resodyn and by the RAM Users Community
- More Effective Means of Explaining the use of the ResonantAcoustic® Mixing Processes for Client Applications are always being Developed
- How Does This work?

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Observed Mixing Regimes




• Physics of Mixing and Processing Underlying the Resodyn Acoustic Resonator Technology are Primarily Driven by **Highly Dynamic and Interactive Phenomena**

• These **Highly Dynamic and Interactive Phenomena** are

- Faraday Instabilities
- Acoustic Wave Forces
- Bubbly and Froth Mixing
- Interfacial Area Creation Dynamics
- Particle Collision and Interaction Mechanisms
- Vapor Cavity Creation and Dynamics



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Same Acoustic Resonator Platform is used for all of the Mixing/Processing Regimes. However, the Physics Driving each Regime are Different




1. Three Key Points

2.   

3.   

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Successful Mixing with RAM is a Multistep Process




1. Identify the Dominant **Material Mixing Properties** (This important aspect of ResonantAcoustic[®] Mixing is Presented in Upcoming Sessions)

2. One must Select the **Mixer Operating Conditions that Align with the Materials Mixing Properties** Throughout the Mix Cycle (Note: Properties of the Mixture Often Change from Start to Finish Sometimes Requiring Adjustment in the Following Settings)

- Acceleration
- Pressure (vacuum)
- Temperature
- Use of both top and bottom transducer is often essential
- Time at specific operating conditions
- Power into the mix

3. Identify when and how the **Materials Mixing Properties Transition** during the Mixing Process

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RAM Mixing and Processing Developments

- Automated Vessel Handling
Status: Implemented
- Continuous Resonant Acoustic Mixing
Status: Implemented and in Further Development to address specific client requirements
- Continuous Resonant Acoustic Chemical Reactor
Status: In Mid-Stage Development – Anticipated **Product Launch 2028**
- Continuous Resonant Acoustic Crystallizer
Status: In Mid-Stage Development – Anticipated **Product Launch 2028**
- Continuous Resonant Acoustic Microreactor
Status: In Mid-Stage Development – Anticipated **Product Launch 2028+**
- Continuous Resonant Acoustic Mechanochemical Reactor
Status: In Conceptual Development – Anticipated **Product Launch 2028+**

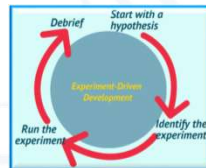


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Resodyn Acoustic Mixers Technology and Processing Knowledge are a

It doesn't matter how beautiful your theory is, it doesn't matter how smart you are. If it doesn't agree with experiment, it's wrong. Richard P. Feynman



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WHERE NO MIXER HAS GONE BEFORE



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Thank you for your
time and attention



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