Applications of RAM Mixing Power

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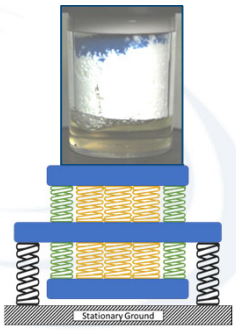
Resodyn Corporation

What is Mix Power?

- RAM Mixing uses an oscillating spring/mass stack on mechanical resonance to facilitate mixing
- Power transmission is driven by the Resonator but is dependent on mixing parameters
- The affect of these mixing parameters on your mix can be un-intuitive.



Most RAM Mixing Vessels Are Opaque

- Traditional inspection of the mixing phenomenon has been based on analysis of the final product, experience, or visual observation.
- Mix Power is a quantitative measure of the rate at which energy is transferred to the system.


Jacketed


OmniRAM & RAM5


Continuous


Mix in Case

Power Into the Mix

200 gm Sugar & 1 gm Iron Oxide

Acceleration: 80 *g*
Mix Time: 6 sec
Avg. Mix Power: 82 W

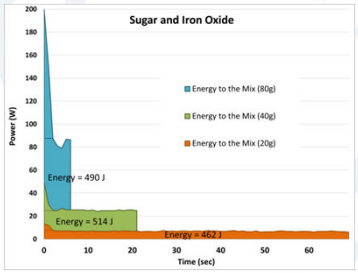
Acceleration: 40 *g*
Mix Time: 21 sec
Avg. Mix Power: 24 W

Acceleration: 20 *g*
Mix Time: 68 sec
Avg. Mix Power: 7 W

Power into the Mix

- Is the total energy used to mix constant?

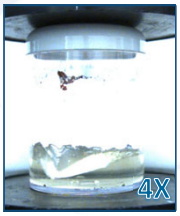
$$Energy = Power * Time$$



Power Into the Mix

80 gm Powder Sugar, 80 gm Corn Syrup & 2 gm Iron Oxide

Acceleration: 100 *g*
Mix Time: 40 sec
Avg. Mix Power: 72 W

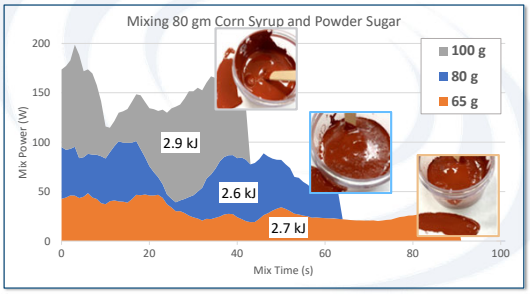


Acceleration: 80 *g*
Mix Time: 62 sec
Avg. Mix Power: 41 W

Acceleration: 65 *g*
Mix Time: 90 sec
Avg. Mix Power: 30 W

Power Into the Mix

$$Energy = Power * Time$$



Four Uses For Mix Power

1. Optimizing Mixing Parameters and Mixture Ingredients for Production
2. Identify Changes to the Mix Regime
3. Identifying Changes in Material Properties
4. Check for Irregularities in Mixing Performance for Established Processes

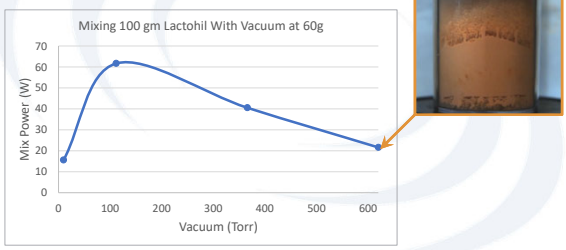
1. Optimizing Mix Parameters

Question:

How can you determine the optimal vacuum for cohesive powders?

1. Optimizing Mix Parameters

Mix Power Helps Identify the Optimal Vessel Pressure



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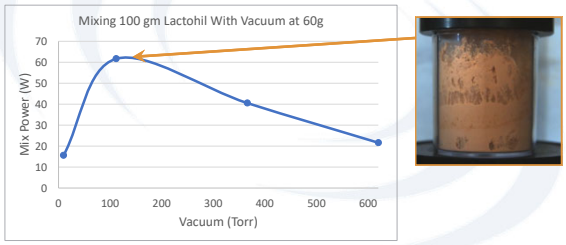

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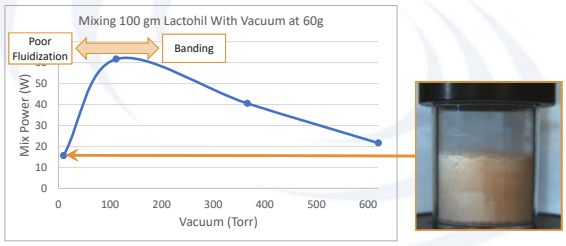
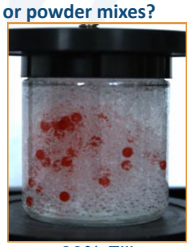


1. Optimizing Mix Parameters

Question:

How can you determine the optimal fill level for liquid, paste, or powder mixes?

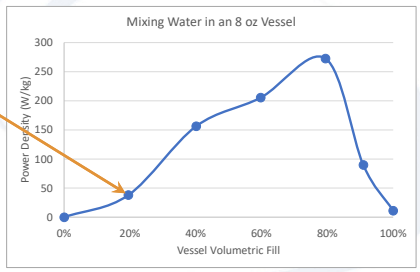


80% Fill
Mixing at 35g

100% Fill
No Mixing at 35g

1. Optimizing Mix Parameters

Mix Power Help Identifies the Optimal Fill



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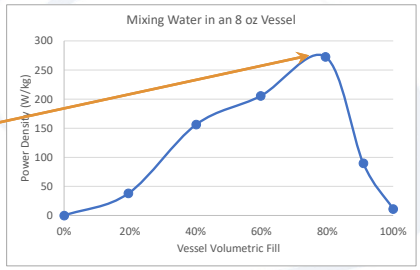

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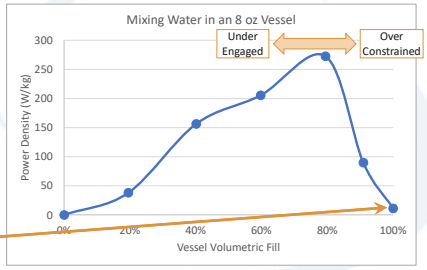

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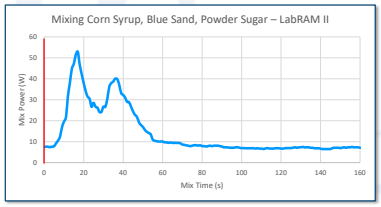
2. Identifying Changing Mixing Regimes

Sudden Changes in Power to Mix May Indicate Changes in the Mixing Regime

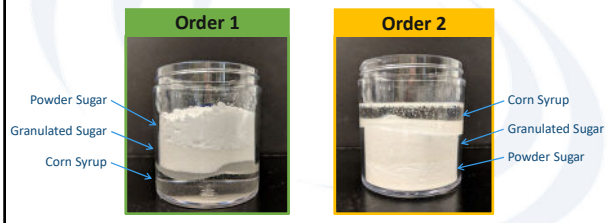


Mixing

1. Optimizing Mix Parameters

Question:

Does Order of Addition affect Mixing Effectiveness?

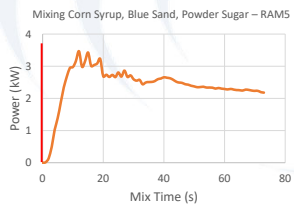


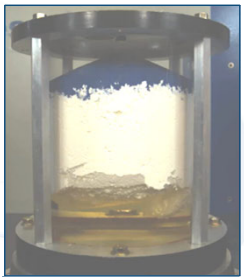
1. Optimizing Mix Parameters

Mix Power Identifies Optimal Order Of Additio

2. Identifying Changing Mixing Regimes

Gradual Changes in Mix Power Identify Changing Material Properties





Mixing

2. Identifying Changing Mixing Regimes

Question:

Can you determine when the mixing regime changes?


Fully Coupled


Mixing


Decoupled

2. Identifying Changing Mixing Regimes

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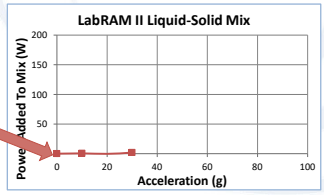
Fully Coupled



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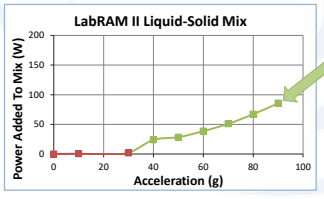


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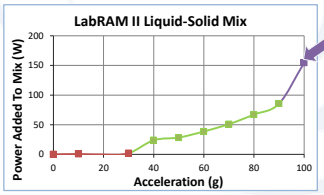

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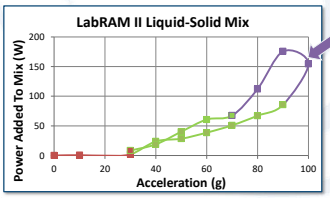

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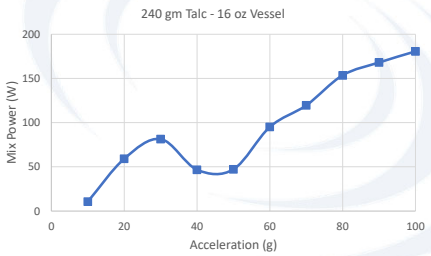
Gradual Changes in Mix Power Identify Changing Material Properties



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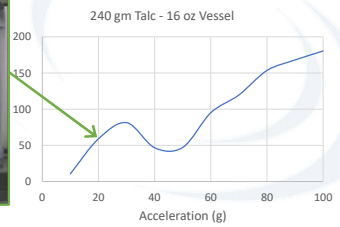

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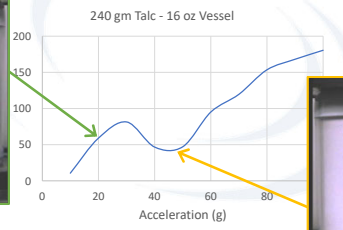

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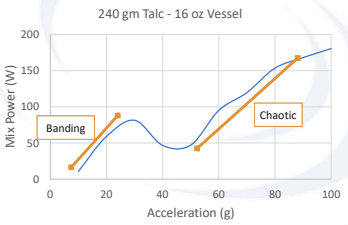

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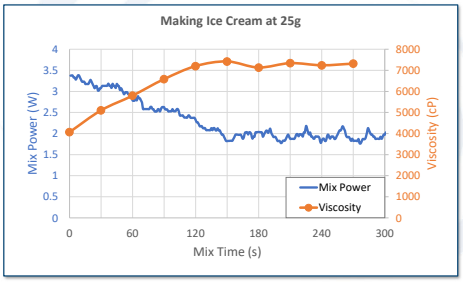
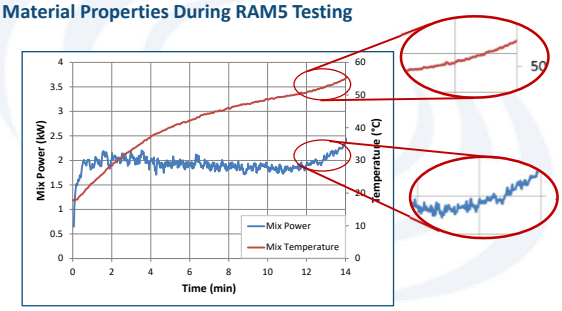


3. Identifying Changing Mix Properties

Mix Power Can be used to Identify and Prevent Changing Material Properties During RAM5 Testing



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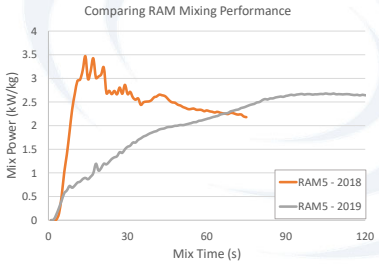
4. Evaluating Mixing Consistency

Question: Can RAM Mixing Power be used to evaluate consistency of the RAM Mixer between runs?



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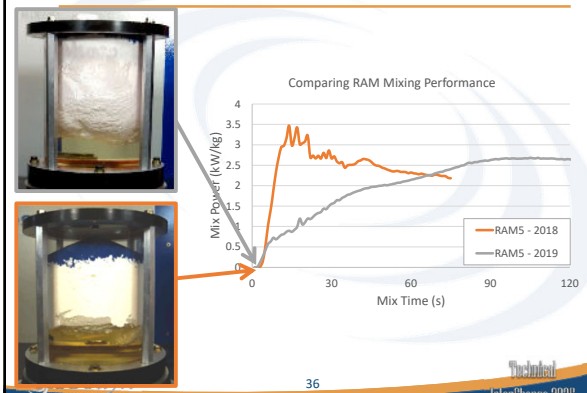
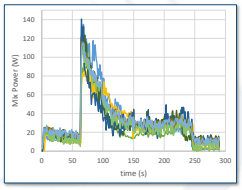


4. Evaluating Mixing Consistency

Mix power is used as a quality control parameter using bi-modal PBX simulant

Mix Ingredients	Run Number	
	1 - 10	11
Component (Density)	%Wt	%Wt
R-45 HTLO	5.17	5.17
DOA	5.17	5.17
Lecithin	0.17	0.17
Hollow Glass Spheres	23.53	89.49
Solid Glass Spheres	65.96	0



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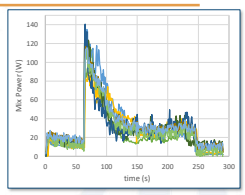

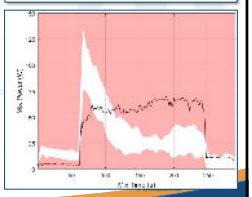

Summary

- RAM presents several processing advantages that can be non-intuitive compared to conventional processes
- Mix Power measures the rate at which work is done on your mix material
- Mix power aids understanding and improves the effectiveness of your mixing operation
  1. Optimizing Mixing Parameters and Mixture Ingredients for Production
  2. Identify Changes to the Mix Regime
  3. Identifying Changes in Material Properties
  4. Check for Irregularities in Mixing Performance for Established Processes

Thank you for your time and attention.

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