THE POWER OF PIGMENT
DRY BLENDING STUDY

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ROTOMOTIVE LIMITED

PRESENTATION OVERVIEW

- Methods & Equipment
- Pigments investigated
- Impact Strength (MFE) results
- Ductile to Brittle transition
- Why is this happening?
- Lessons learned
- “Thank-you’s”

METHODS & EQUIPMENT

1. Pigments mixed with ExxonMobil™ LL8460.29 powder in a planetary blender at ambient temperature
2. Mixtures molded in a “double hex” steel tool, using a uniaxial gas-fired rotomolding machine
3. Cook conditions controlled using modified K-PAQ to monitor IAT in real time
4. Thickness conformity checked using a K-METRON magnetic tester
5. Molded parts marked & cut to produce 24 sample plaques from each molded part (5” x 5” x $^{1}/_{8}$” thick)
6. Sample plaques conditioned at -40° for 48 hours
7. Impact testing to ARM procedure using a 10 lb dart

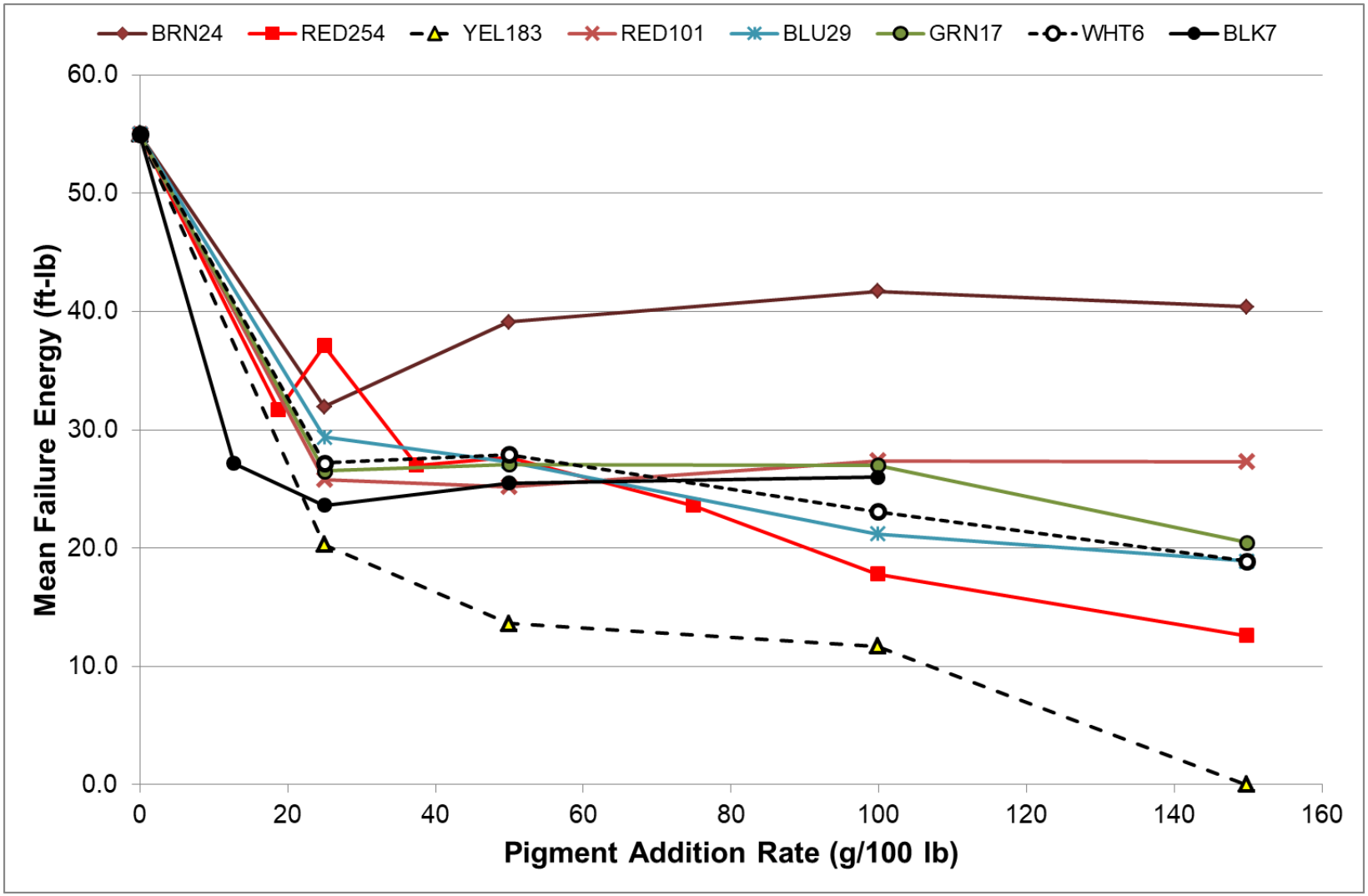
PIGMENT TYPES

Color	Color Index Number	Pigment Name	Type
	Brown 24	Chrome antimony titanium buff	Inorganic
	Red 254	Yellow shade dieto-pyrrole-pyrrole	Organic
	Yellow 183	Red shade monoazo	Organic
	Red 101	Red iron oxide	Inorganic
	Blue 29	Ultramarine Blue	Inorganic
	Green 17	Chrome oxide	Inorganic
	White 6	Titanium Dioxide	Inorganic
	Black 7	Carbon Black	Inorganic

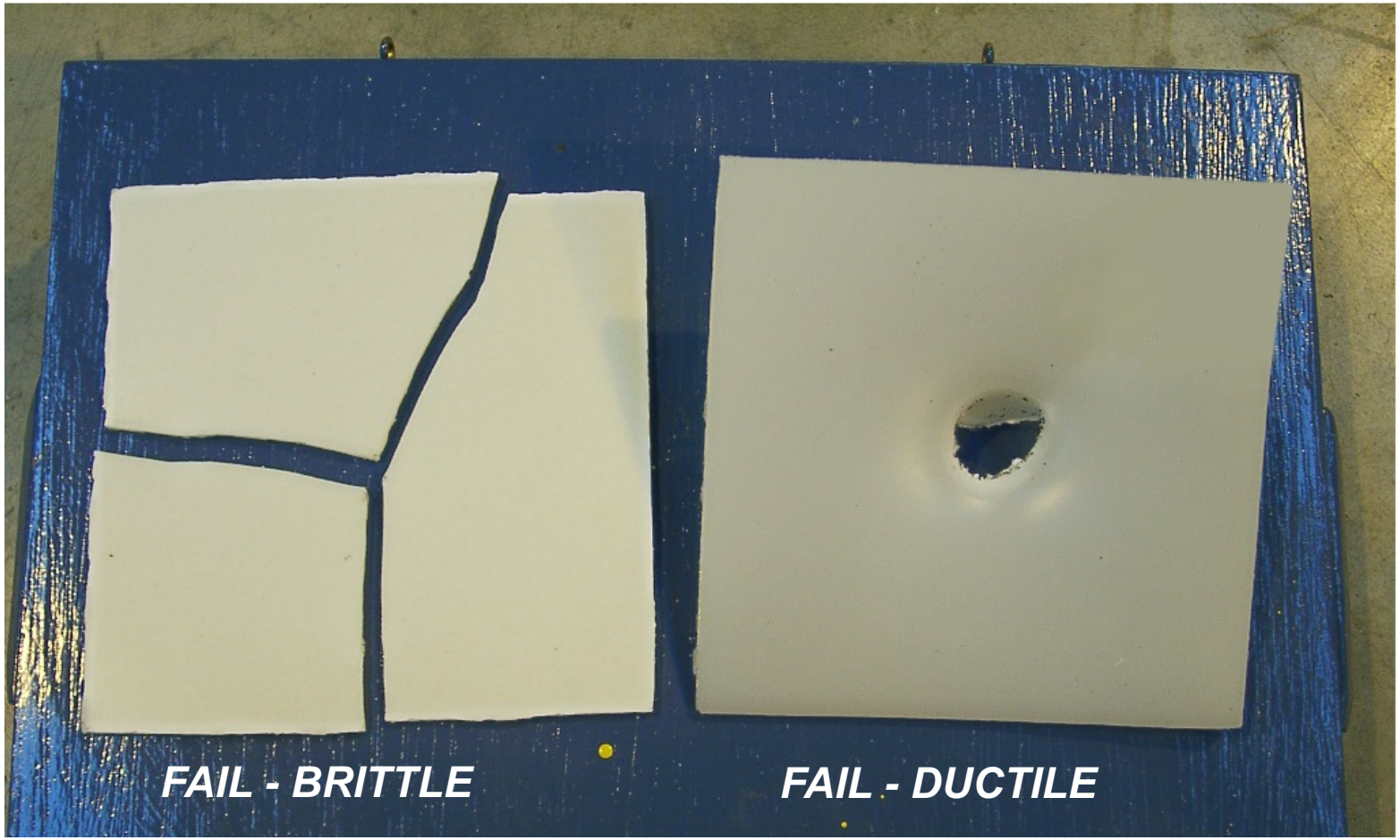
PIGMENT ADDITIONS

Addition Rate (%)	Addition Rate (g / kg)	Addition Rate (g / 100 lb)
0	0	0
.055	.55	25
.110	1.10	50
.220	2.20	100
.330	3.30	150

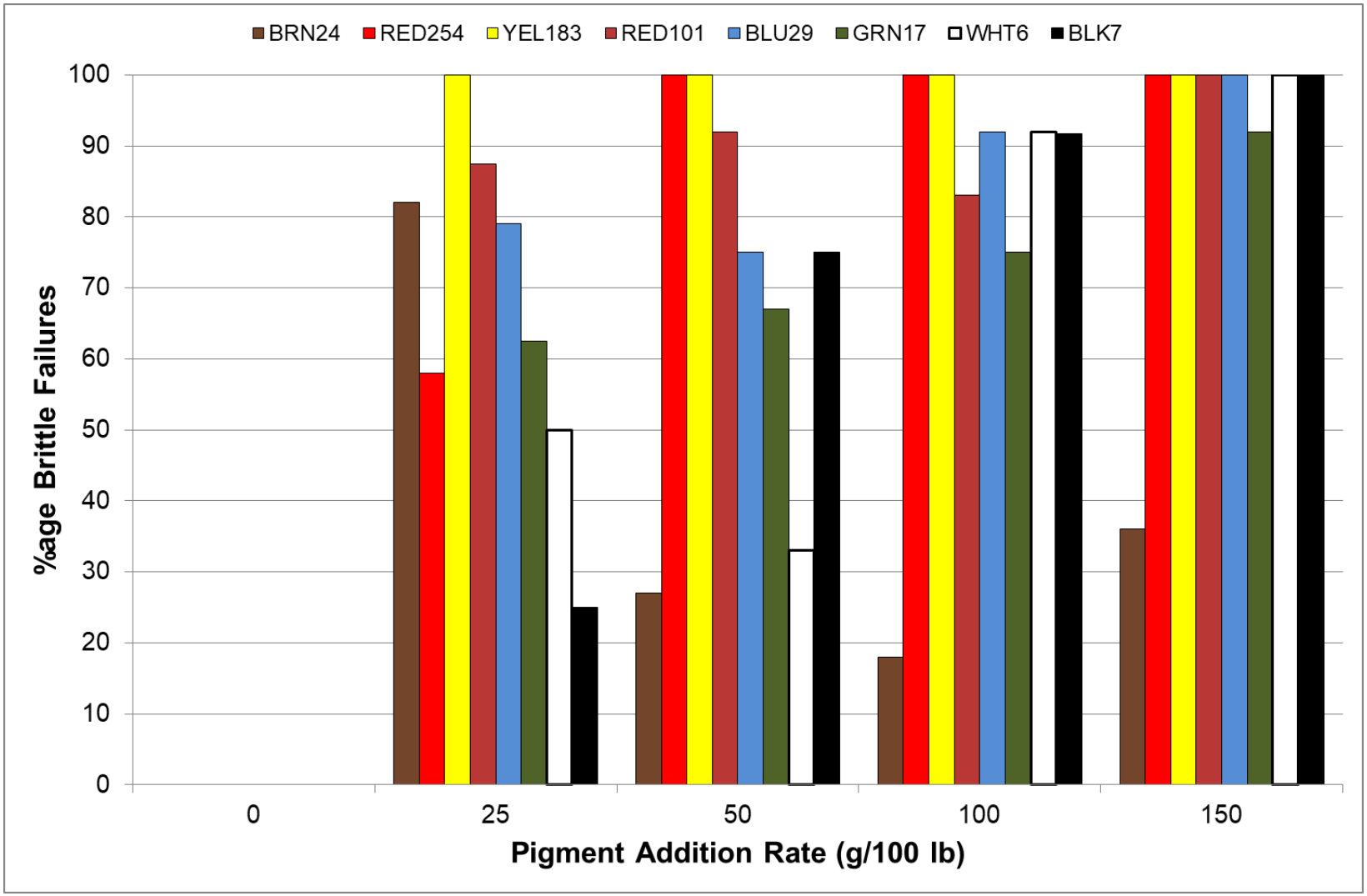
MEAN FAILURE ENERGY



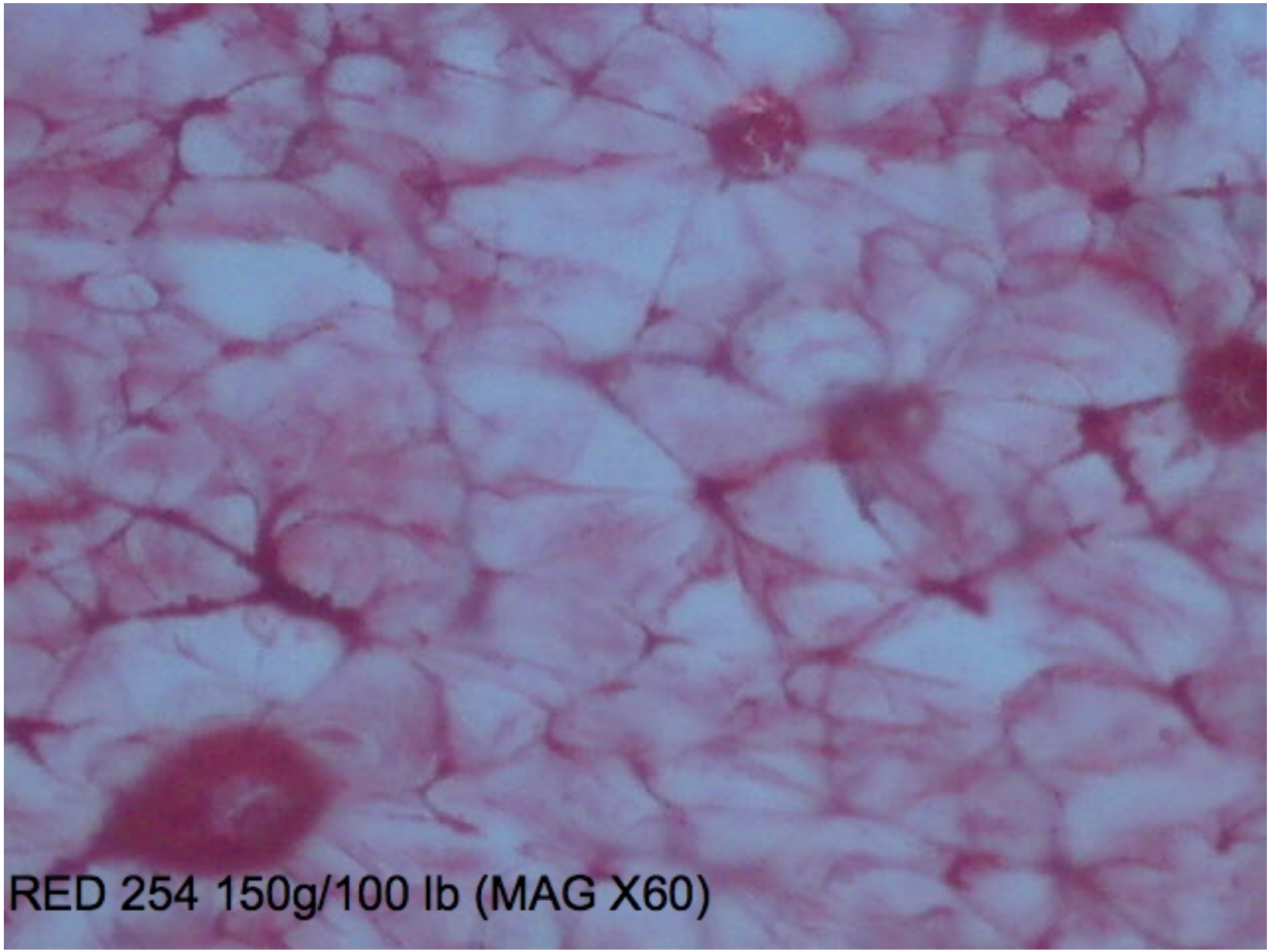
FAILURE MODES



DEVELOPMENT OF BRITTLENESS



WHY IS THIS HAPPENING?



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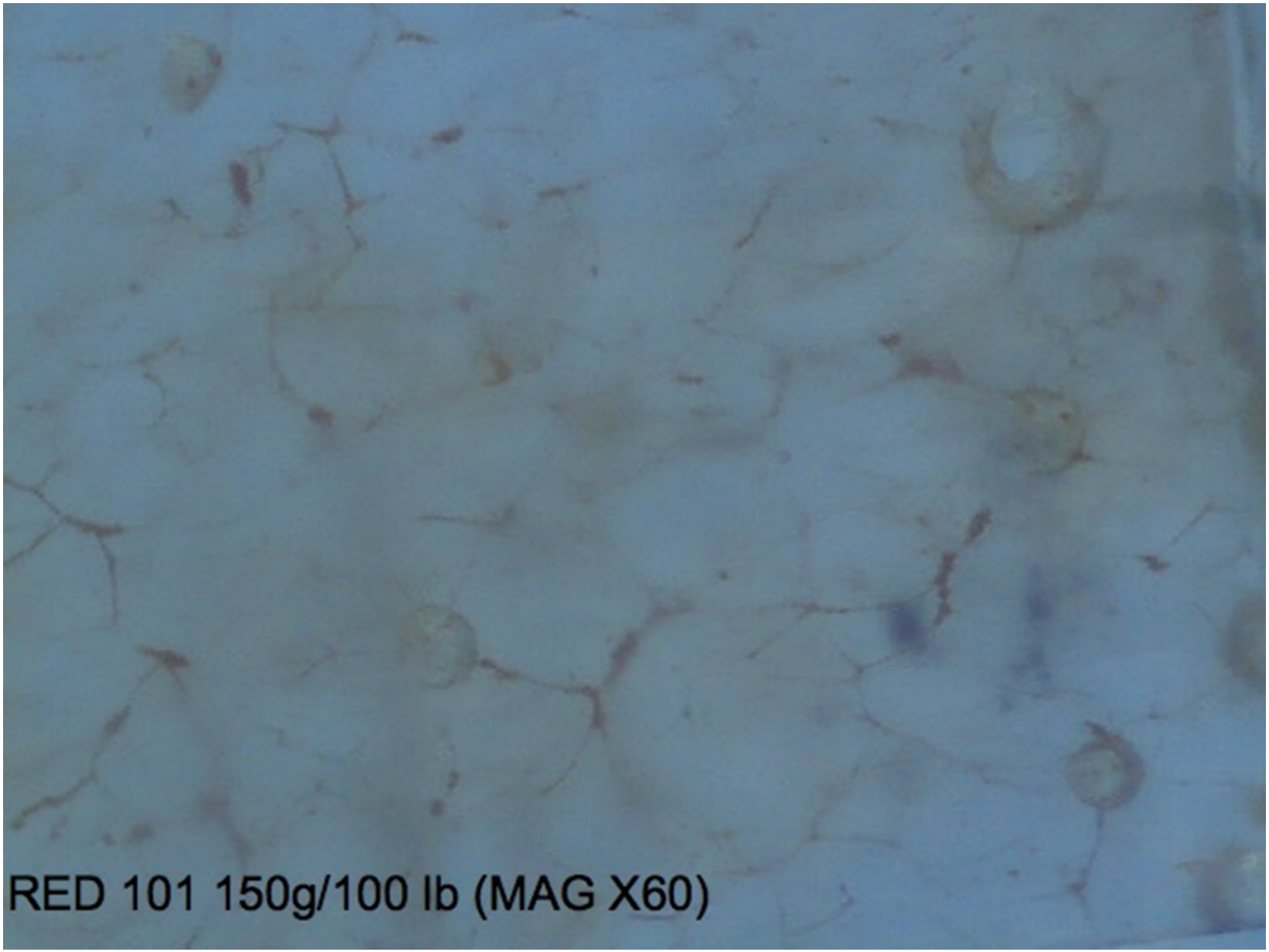

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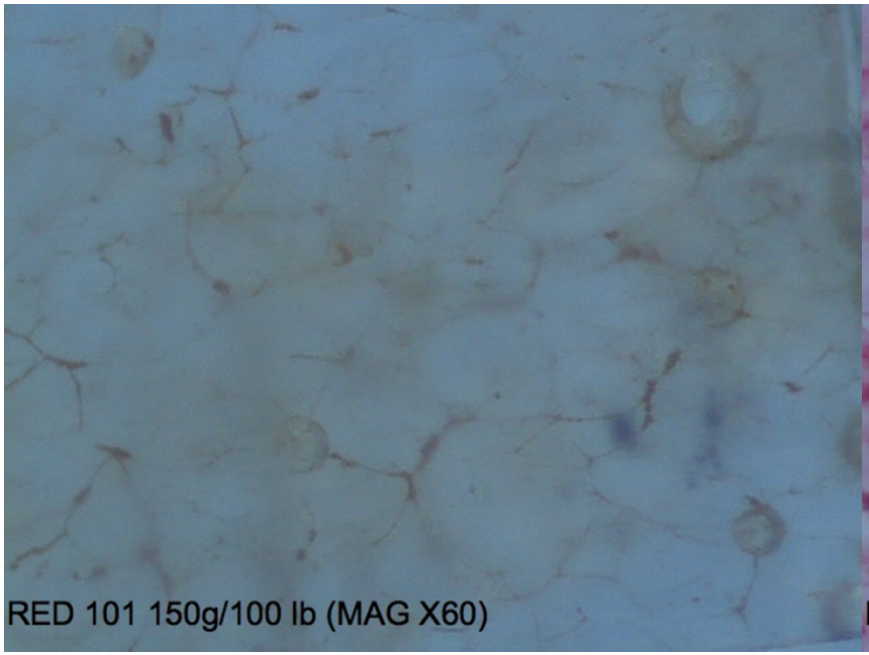

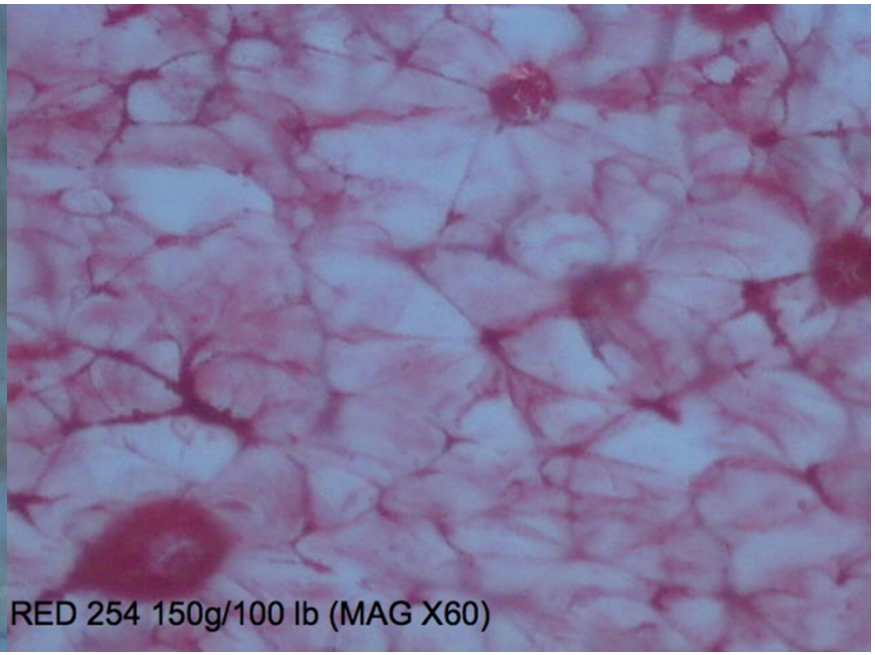

Differences in pigment particle size / bulk density?

Differences in dispersion / clumping?

Differences in heat stability?

LESSONS LEARNED

- Expect a 30-60% loss of impact strength with most pigments
- Expect a severe loss of ductility, especially at low ambient temperatures
- Be wary of using organic reds & yellow, but recognize that sometimes this may be unavoidable
- Use as low an addition rate as possible
- Recognize that good pigments aren’t cheap
- If in doubt – TEST!

GRATEFUL THANKS

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ExxonMobil Chemical

Colleagues in ARM, both old & new