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Title: Summary of Results from First Experiment on Multi-Crystal Titanium Sample

Author(s): Rigg, Paulo A.
Cerreta, Ellen Kathleen

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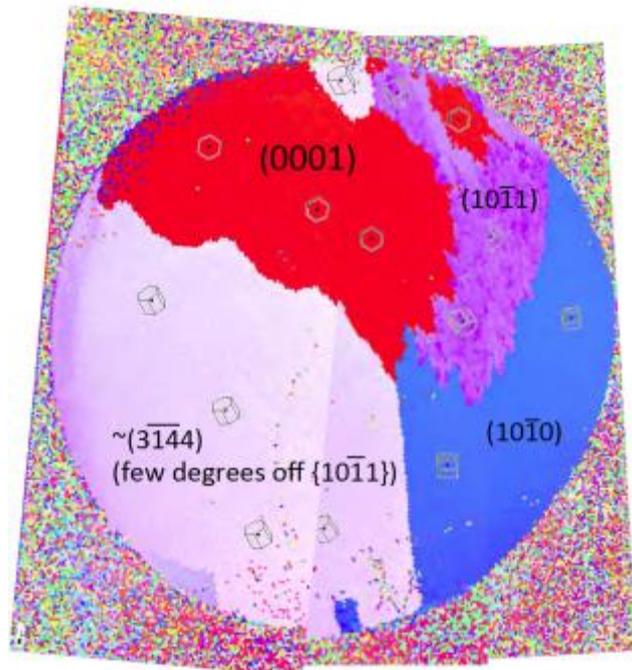
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Summary of Results from First Experiment on Multi-Crystal Titanium Sample

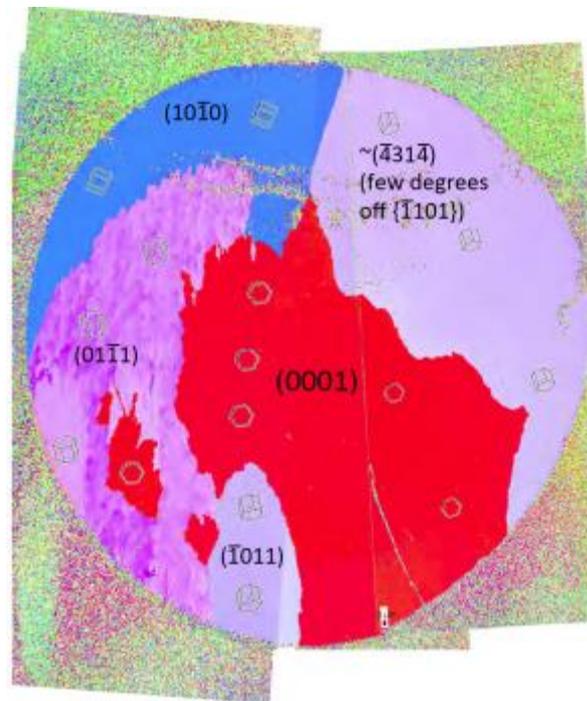
Paulo Rigg and Ellen Cerreta

Three samples were sliced from a large-grain Ti sample

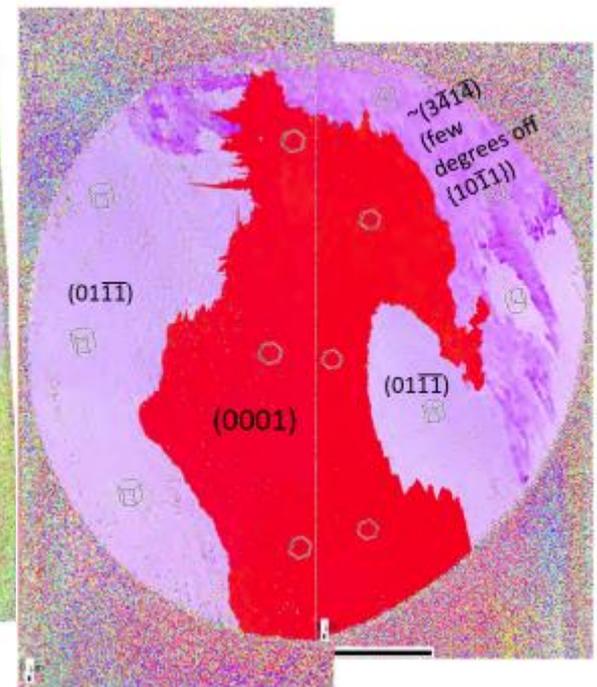
Sample A



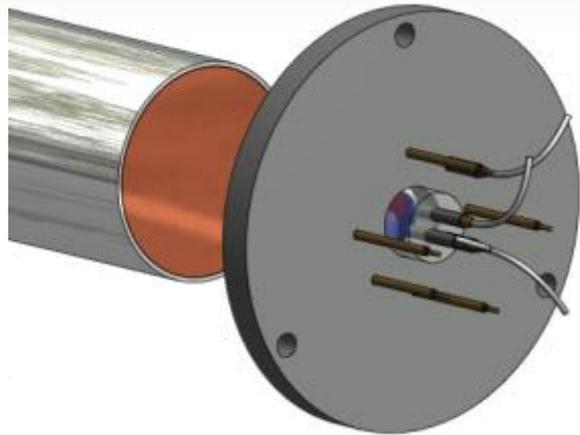
Sample B



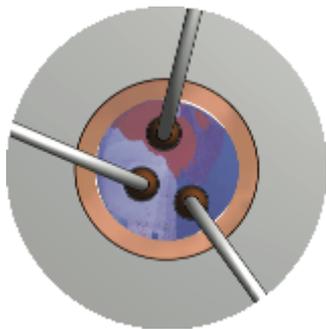
Sample C



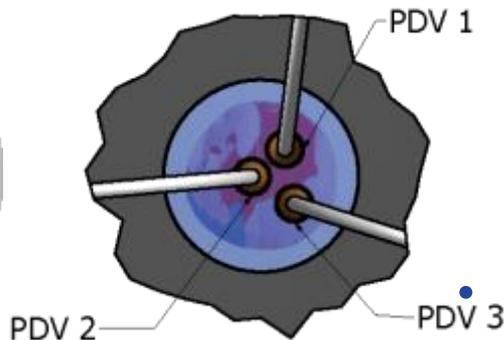
Performed two plate impact experiments to look for α to ω transition in multi-grain Ti samples.



- Copper impactor used to generate shock in multi-crystal Ti sample.
- PDV probes were positioned to obtain the particle velocity at the free surface from a single grain.
- PZT pins were used to determine impact time.
- Cross-timing between pins and PDV were used to roughly determine the shock velocity.
 - Difficult to do cross-timing accurately.
 - Shock velocities should be verified independently in the future.
- Hugoniot points (stress, density, and particle velocity) were determined using impedance matching and the Jump Conditions.



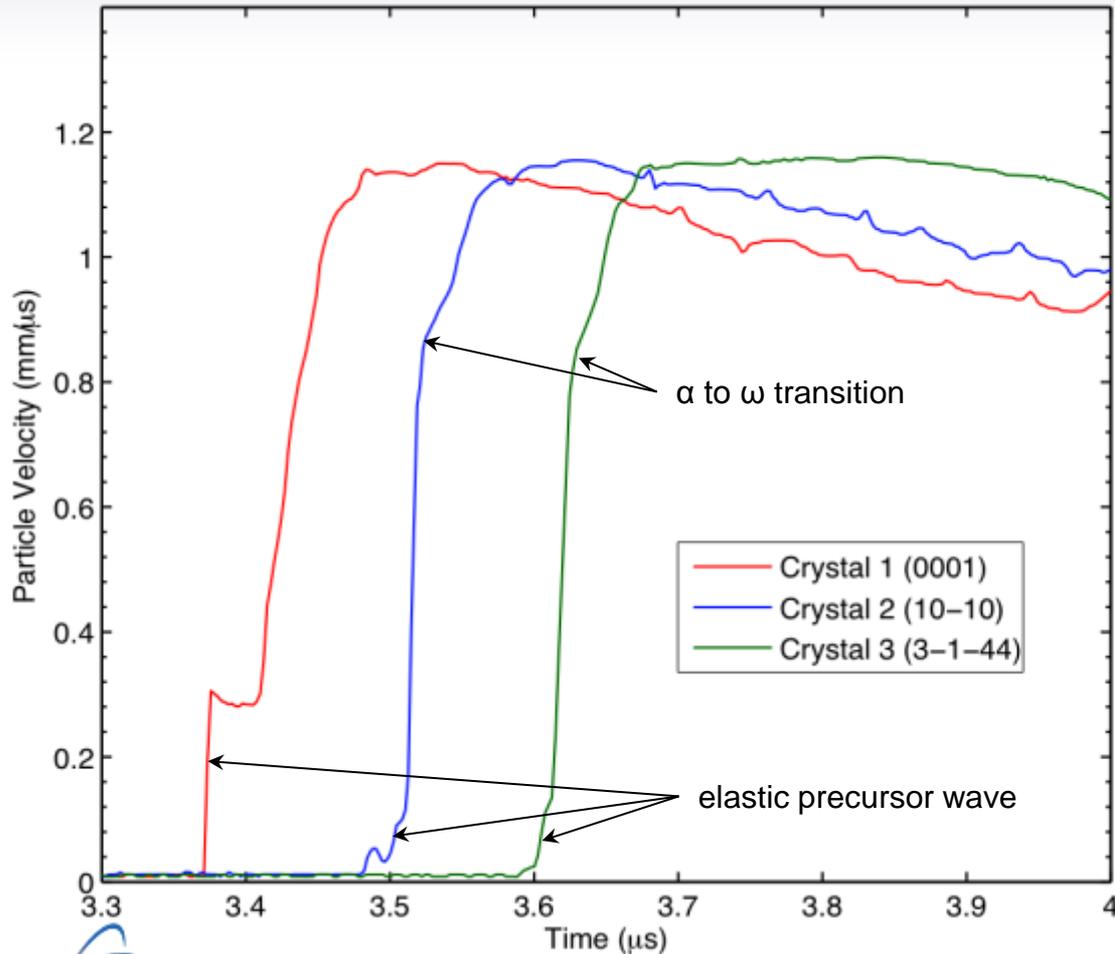
Shot 1



Shot 2

Wave Profiles from Experiment 1

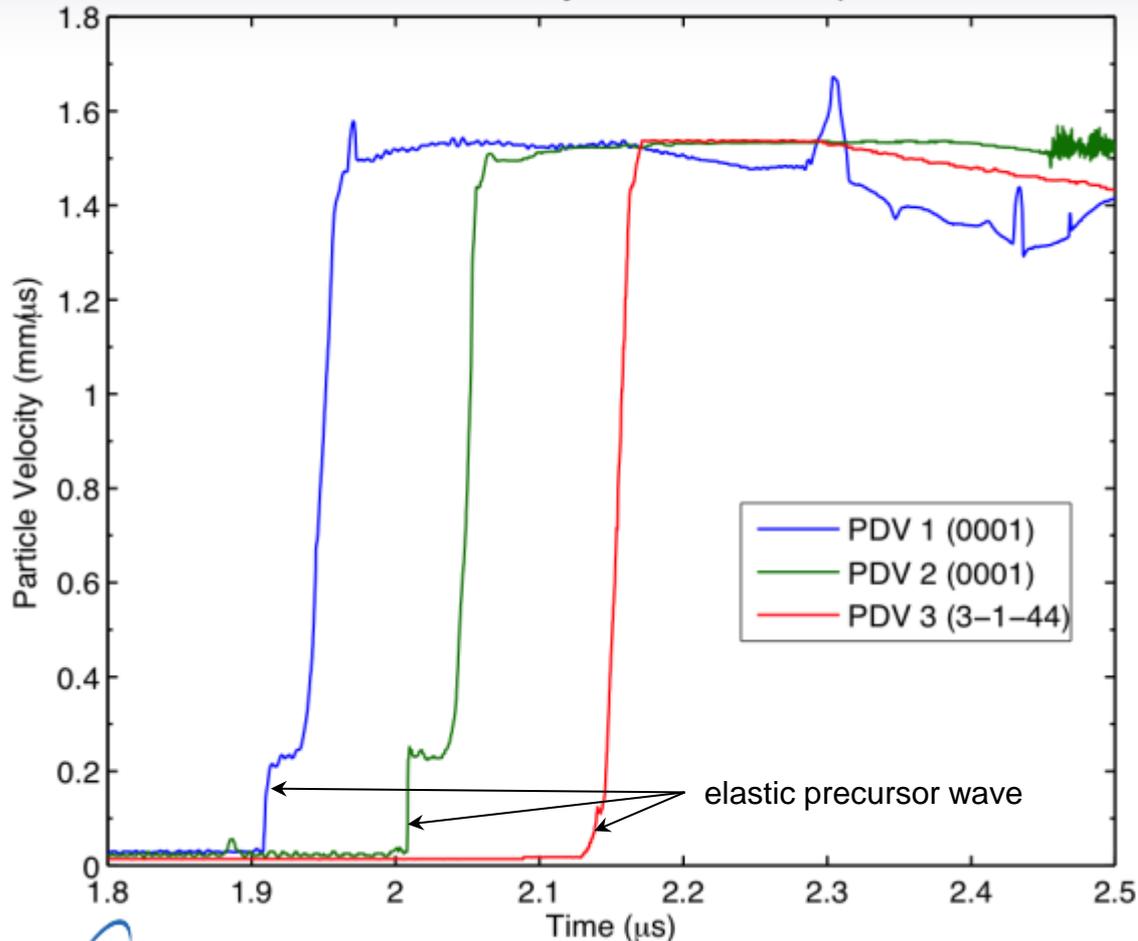
Results from Multi-Crystal Titanium



- α to ω transition observed in 2 orientations at ~ 11 GPa.
 - Consistent with pure and A70 polycrystalline Ti.
- Very high elastic precursor observed along (0001) direction.
- α to ω transition in (0001) direction likely occurs at a higher stress.
 - How much higher??

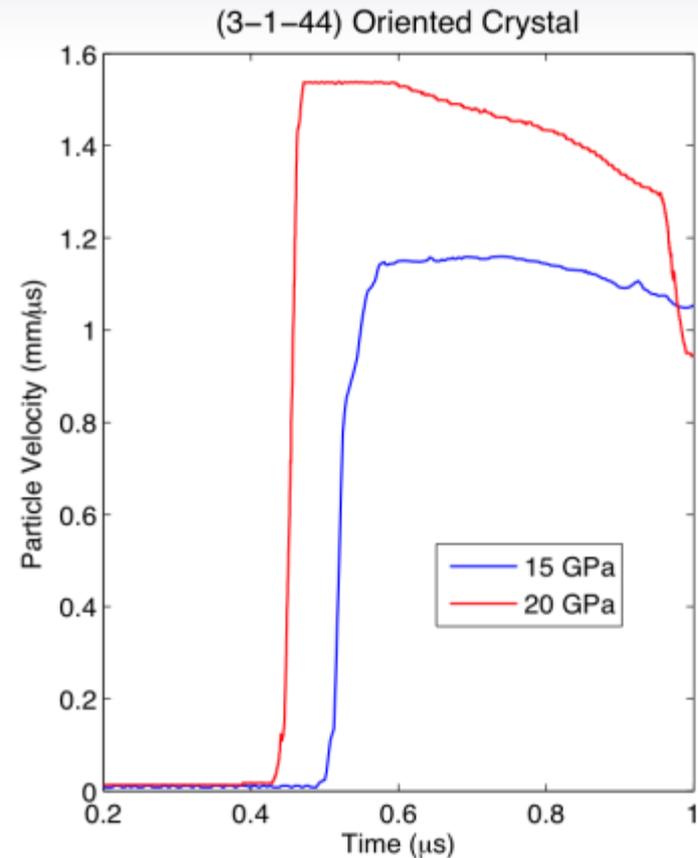
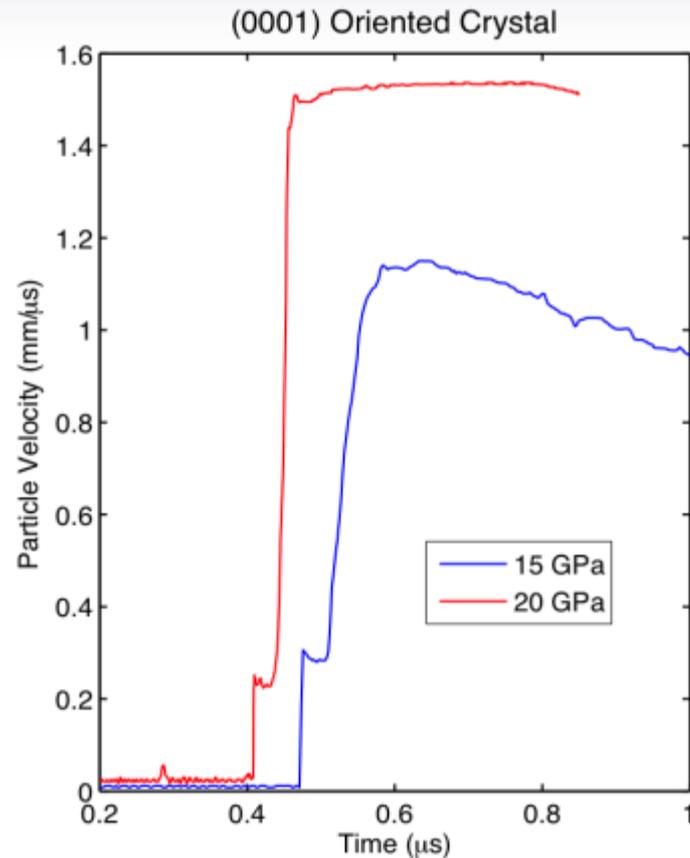
Wave Profiles from Experiment 2

Results from Multi-Crystal Titanium Experiment 2



- No three wave structure observed
- High elastic precursor again observed along (0001) direction.

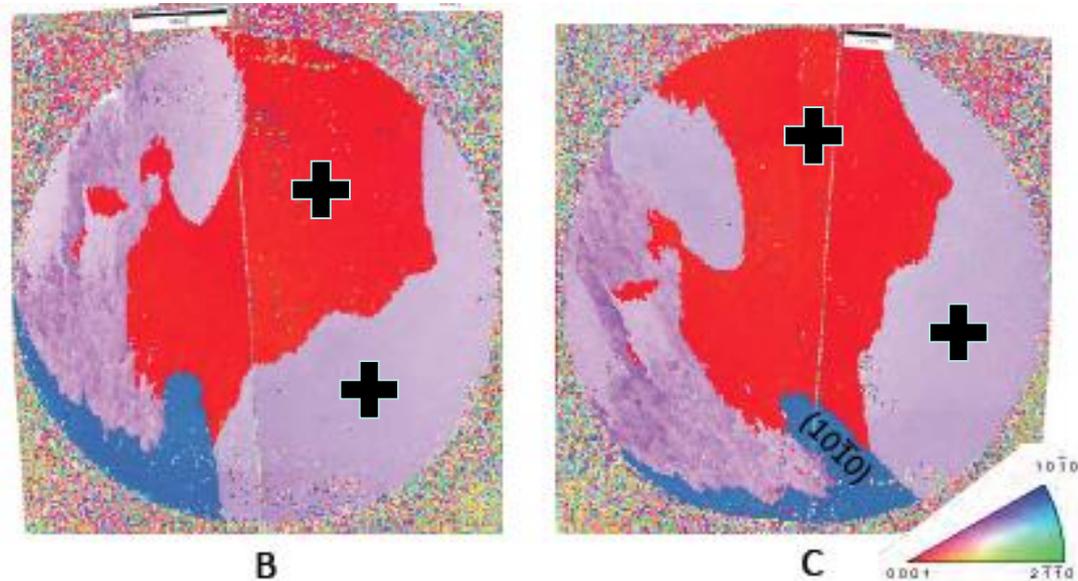
Comparison of Two Experiments



Longitudinal sound speed measurements (J. P. Escobedo-Diaz)

Long. Sound speed (mm/ μ s)		
Orientation	Sample B	Sample C
Red grain +	$6.352 \pm .012$	$6.359 \pm .015$
Purple grain +	$6.041 \pm .009$	$6.096 \pm .026$

FYI: The reported C_L for poly Ti is $6.07\text{mm}/\mu\text{s}$



Estimated Hugoniot parameters from each grain

Hugoniot Parameters	Crystal Orientation		
	(0001)	(10 $\bar{1}$ 0)	(3 $\bar{1}$ 44)
U_S^{EL} (mm/ μ s)	6.44 ± 0.06	5.80 ± 0.05	5.78 ± 0.05
u_P^{EL} (mm/ μ s)	0.210 ± 0.008	0.048 ± 0.005	0.048 ± 0.005
P^{EL} (GPa)	6.1 ± 0.2	1.3 ± 0.1	1.2 ± 0.1
ρ^{EL} (g/cm ³)	4.679 ± 0.008	4.564 ± 0.006	4.564 ± 0.006
U_S^α (mm/ μ s)	5.1 ± 0.2	5.5 ± 0.2	5.5 ± 0.2
u_P^α (mm/ μ s)	0.585 ± 0.005	0.43 ± 0.02	0.43 ± 0.02
P^α (GPa)	14.9 ± 0.2	10.9 ± 0.5	10.8 ± 0.5
ρ^α (g/cm ³)	5.06 ± 0.02	4.91 ± 0.02	4.91 ± 0.02
U_S^ω (mm/ μ s)	–	4.9 ± 0.2	4.9 ± 0.2
u_P^ω (mm/ μ s)	–	0.594 ± 0.006	0.596 ± 0.006
P^ω (GPa)	–	14.5 ± 0.3	14.4 ± 0.3
ρ^ω (g/cm ³)	–	5.09 ± 0.02	5.10 ± 0.02

Comparison of Results to Marsh Data

