NANOVEA

MICROPARTICLES

COMPRESSION STRENGTH & MICRO INDENTATION BY TESTING SALTS

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INTRODUCTION

Compression strength has become vital to quality control measurement in developing and improving new and existing microparticles and micro features (pillars and spheres) seen today. Microparticles have various shapes, sizes and can be developed from ceramics, glass, polymers, and metals. Uses include drug delivery, food flavor enhancement, concrete formulations among many others. Controlling the mechanical properties of microparticles or microfeatures are critical for their success and requires the ability to quantitatively characterize their mechanical integrity.

IMPORTANCE OF DEPTH VERSUS LOAD COMPRESSION STRENGTH

Standard compressive measurement instruments are not capable of low loads and fail to provide adequate depth data for microparticles. By using Nano or Micro indentation, the compression strength of nano or microparticles (soft or hard) can be accurately and precisely measured.

MEASUREMENT OBJECTIVE

*In this application note we measure the compression strength of salt with the **NANOVEA Mechanical Tester** in micro indentation mode.*

NANOVEA
CB500

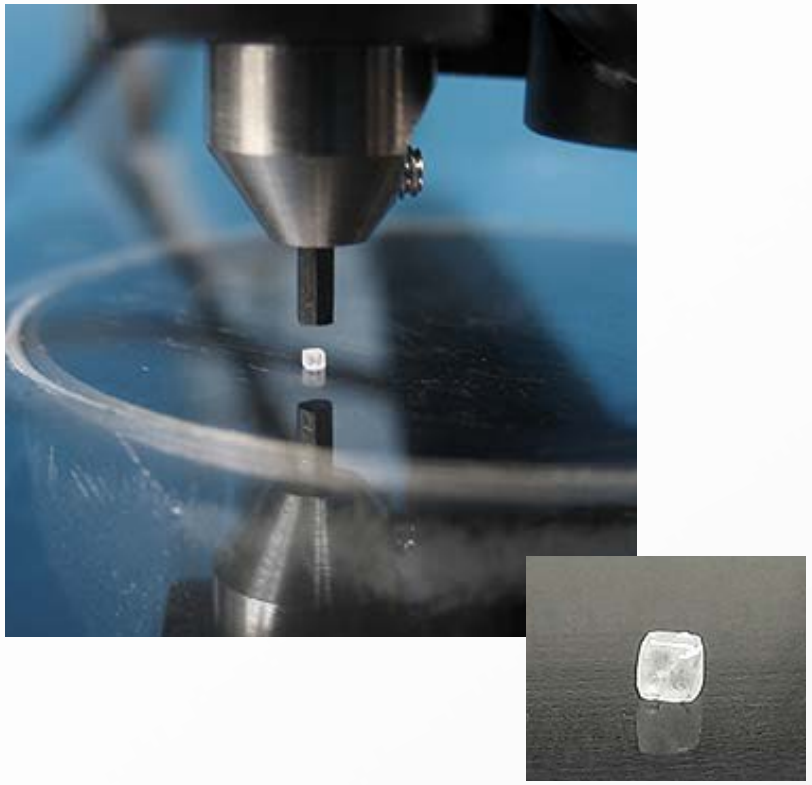
TEST CONDITIONS

MAXIMUM FORCE	LOADING RATE	UNLOADING RATE
30 N	60 N/min	60 N/min

INDENTER TYPE

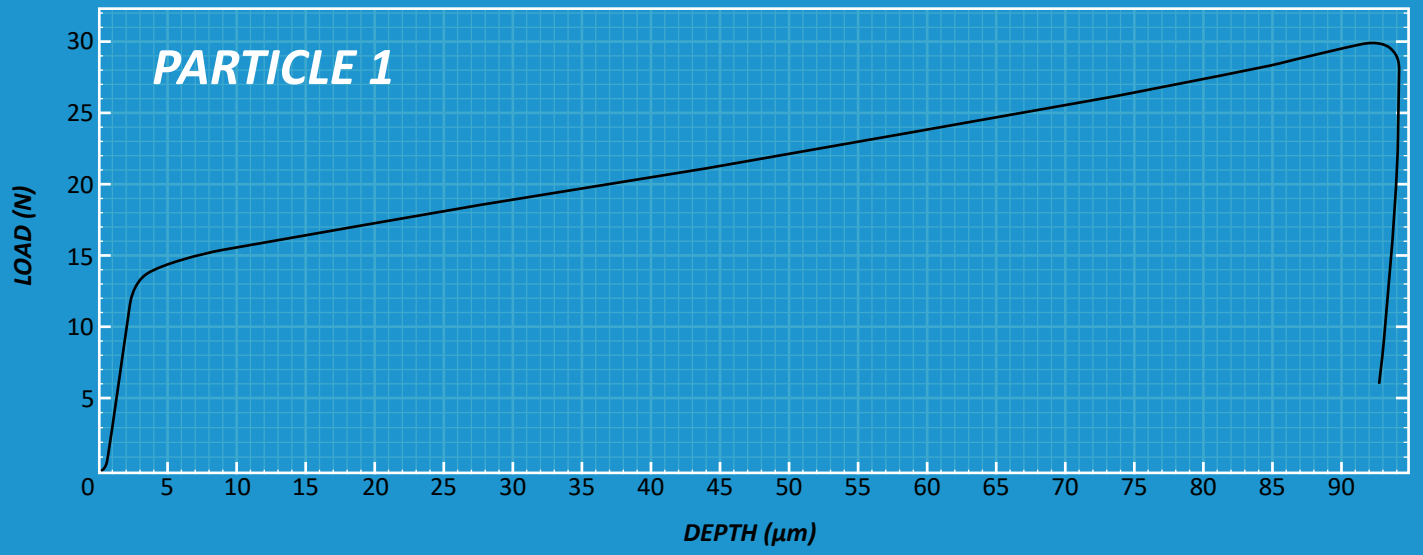
Flat Punch

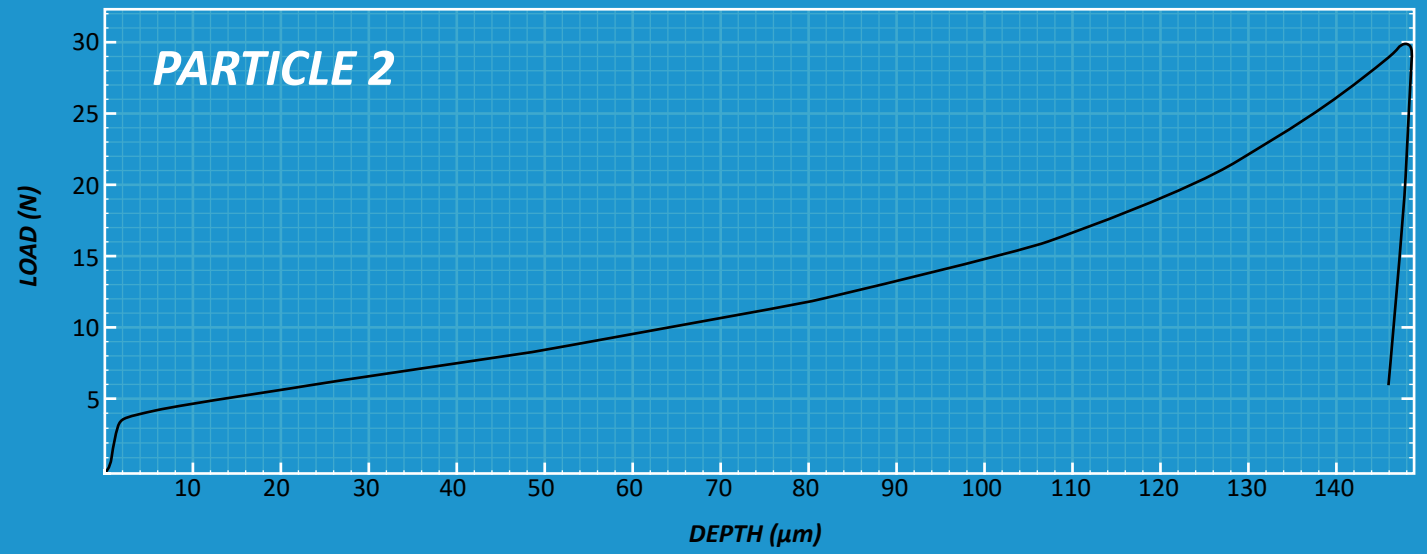
Steel | 1 mm Diameter



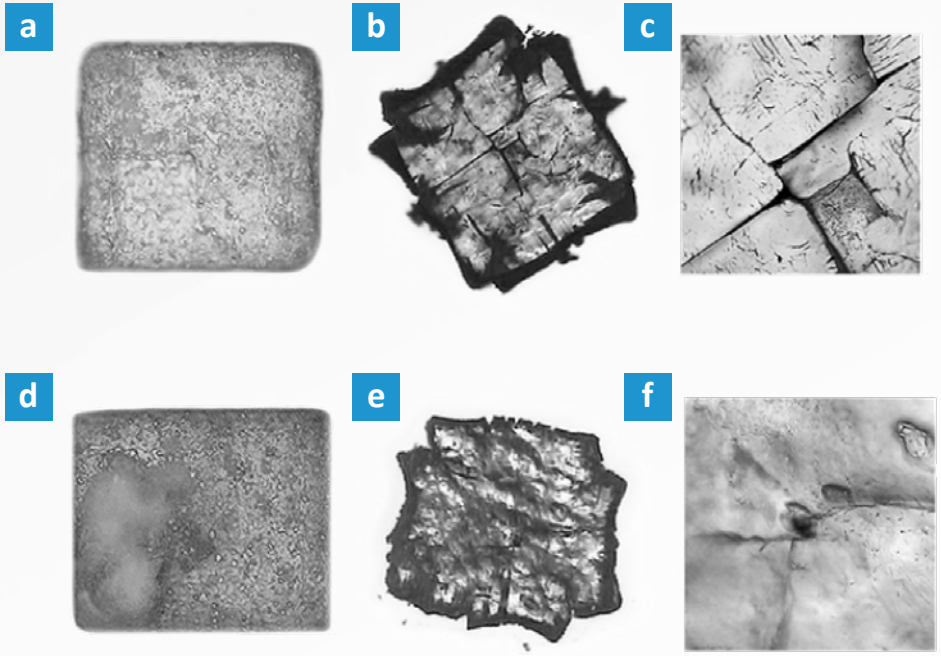
The tested sample

LOAD VS DEPTH CURVES





RESULTS & DISCUSSION



a Particle 1 before test
b Particle 1 after test
c Particle 1 after test zoomed in

c Particle 2 before test
e Particle 2 after test
f Particle 2 after test zoomed in

	Particle Height (μm)	Failure Load (N)	Strength at Failure (MPa)
Particle 1	377	12.5	88
Particle 2	250	3.4	54

Height, failure force and strength for Particle 1 and Particle 2

Particle failure was determined to be the point where the initial slope of the force vs. depth curve began to noticeably decrease. This behavior shows the material has reached a yield point and is no longer able to resist the compressive forces being applied. Once the yield point is surpassed, the indentation depth begins to exponentially increase for the duration of the loading period. These behaviors can be seen in ***Load vs Depth Curves*** for both samples.

CONCLUSION

In conclusion, we have shown how the ***NANOVEA*** Mechanical Tester in micro indentation mode is a great tool for compression strength testing of microparticles. Although the particles tested are made of the same material, it is suspected that the different failure points measured in this study were likely due to pre-existent micro cracks in the particles and varying particle sizes. It should be noted that for brittle materials, acoustic emission sensors are available to measure the beginning of crack propagations during a test.

The ***NANOVEA*** Mechanical Tester offers depth displacement resolutions down to the sub nanometer level, making it a great tool for the study of very fragile micro particles or features as well. For soft and fragile materials, loads down to 0.1mN are possible with our nano indentation module.