Fine particle shot media

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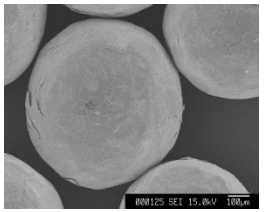
FPSP Background

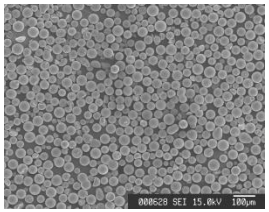
FPSP (Fine Particle Shot Peening)
has been mainly developed
in Automobile Industry in Japan
and applied to a number of steel parts

[FPSP]

- Media size : d < less than 1/10
- Media : non metallic shot
- Speed : high velocity (up to 200m/s)

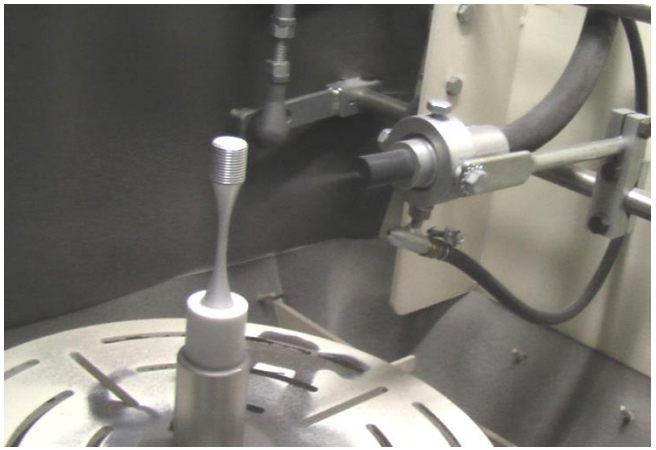


Typical Steel shot



Fine particle (<53 μm)

– 100μm

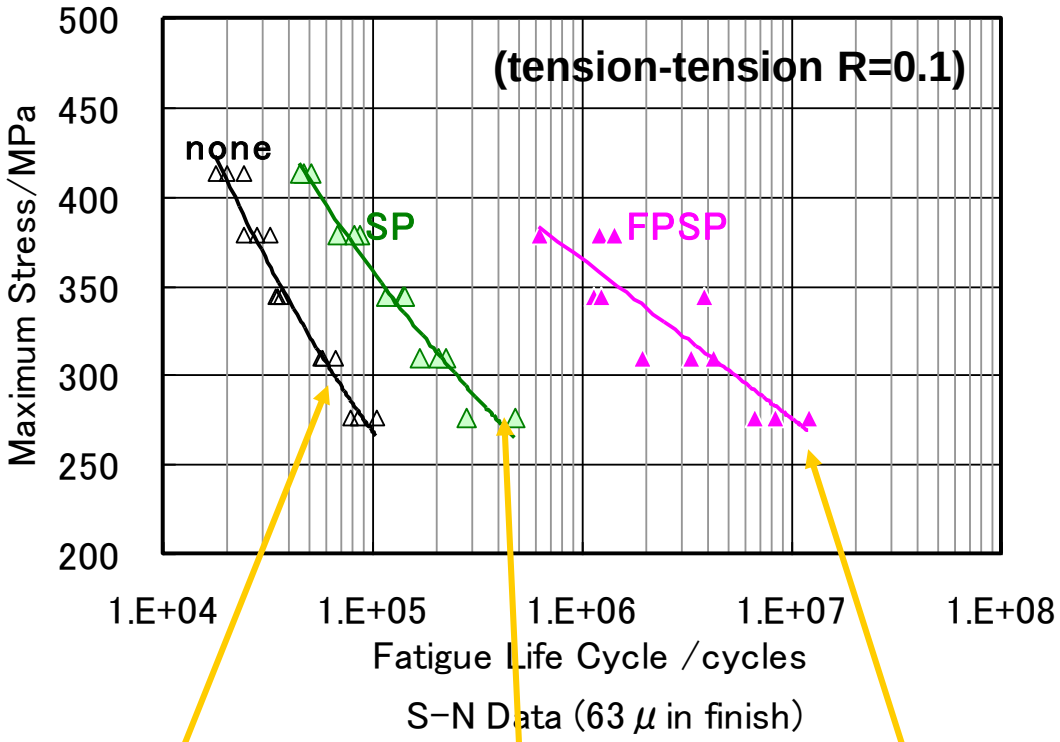


[Property]

-Good tribological property

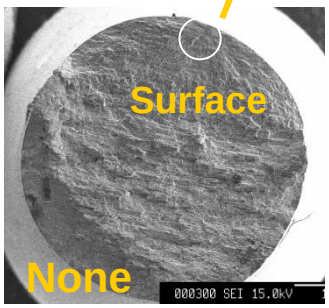
-Good fatigue property

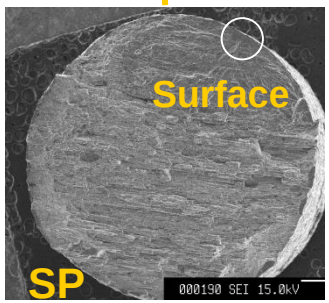
FPSP fatigue data (Rod coupon)

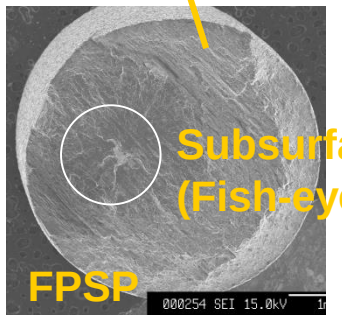


Fatigue life is
Strongly affected by
Crack initiation position

Fatigue life cycle by surface crack initiation is one or more shorter than Subsurface crack initiation

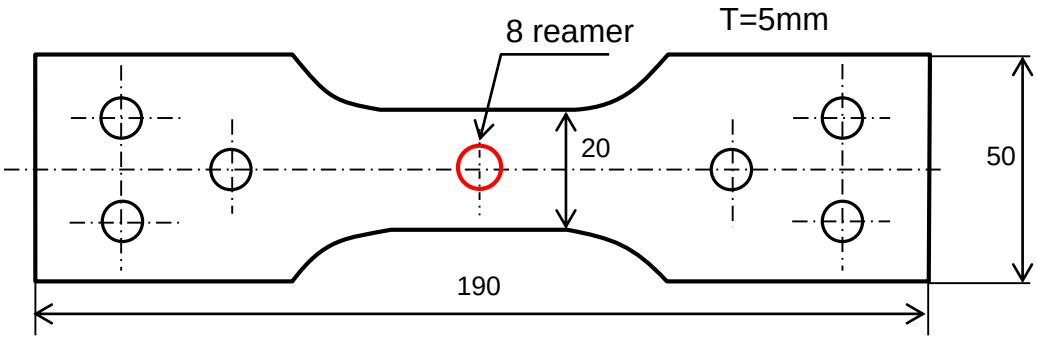




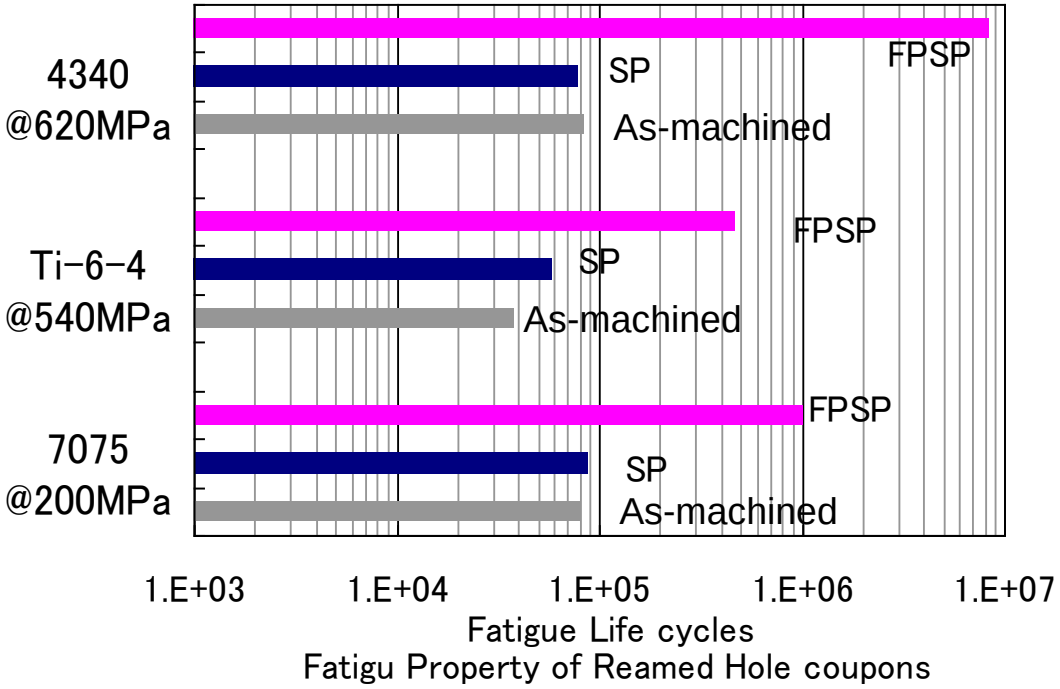


FPSP fatigue data (open hole coupon)

Fatigue test results of
Plate with f8mm hole



Average number of 3 samples at fracture (tension-tension R=0.1)



Fatigu Property of Reamed Hole coupons

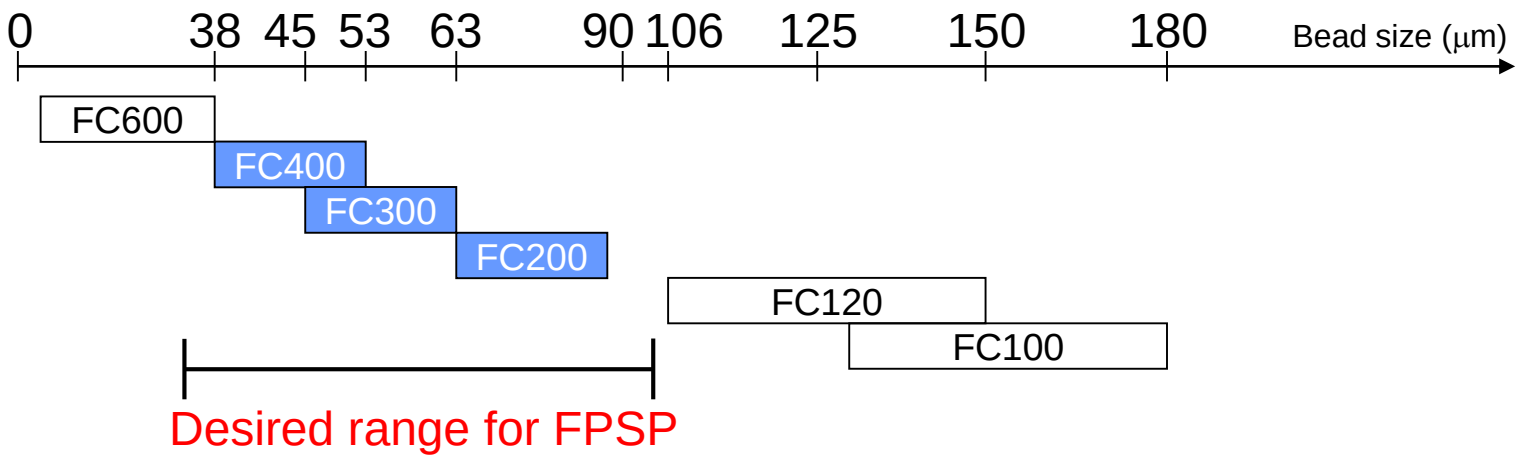
FPSP improved
Fatigue property
of all types of
materials

FPSP media (Bead size)

MITSUBISHI HEAVY INDUSTRIES, LTD.

Low Sodium Glass Beads (AMS 2431/10) : suitable size for FPSP

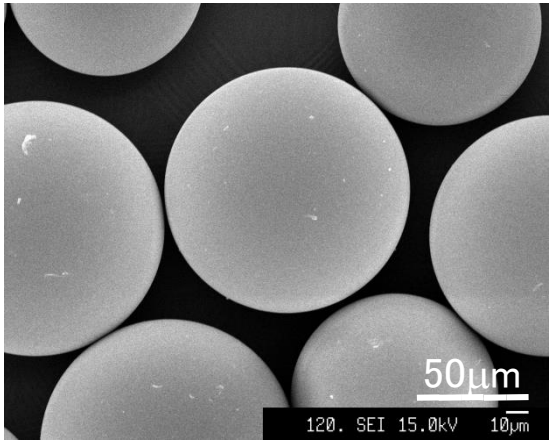
	Nominal Sizes, Millimeters	Nominal Sizes, Mesh	Sieve Size, Maximum 0.40%		Sieve Size, Mesh		Sieve Size, Minimum		Maximum % of broken or angular beads
			Mesh	Mesh size [mm]	Max. 5% Retained	Max. 15% Passing	Max. % of passing	Sieve Size, Mesh/mm	
FC100	0.125/0.180	120/80	70	0.212	80	120	5	140/0.106	10
FC120	0.106/0.150	140/100	80	0.180	100	140	5	170/0.090	10
FC200	0.063/0.090	230/170	140	0.106	170	230	5	270/0.053	5
FC300	0.045/0.063	325/230	200	0.075	230	325	10	400/0.038	5
FC400	0.038/0.053	400/270	230	0.063	270	400	15	400/0.038	5
FC600	0.010/0.038	- /400	325	0.045	400	-	20	/0.010	5



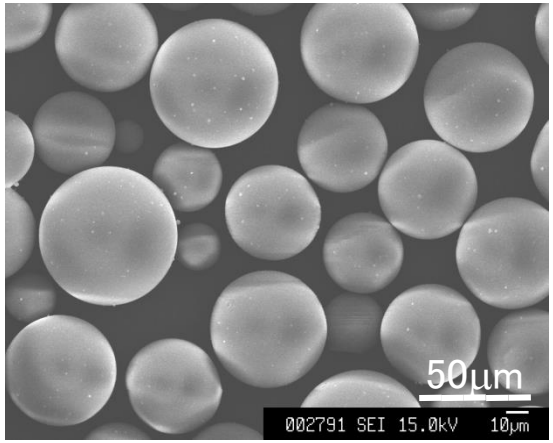
FPSP media (Characteristics and shape)

MITSUBISHI HEAVY INDUSTRIES, LTD.

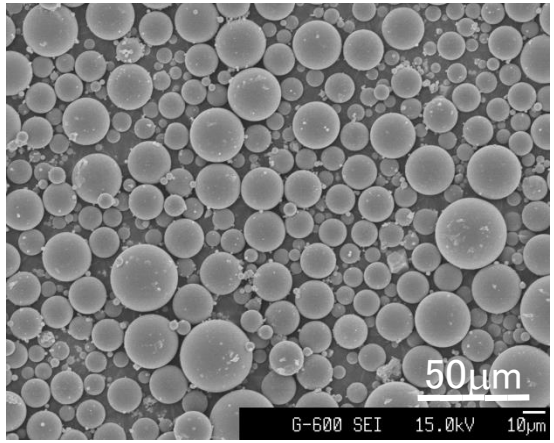
- Composition
  CaO : 21-25% , Al_2O_3 : 12-15% , B_2O_3 : 4-8% , MgO : 0.8-1.2%
  Na_2O+K2O : 0.3-1% , SiO_2 : Balance
- Density 2.6 (same as Glass beads)
- Appearance smooth surface and spherical shape



FC120 (106/150μm)



FC300 (45/63μm)



FC600 (10/38μm)

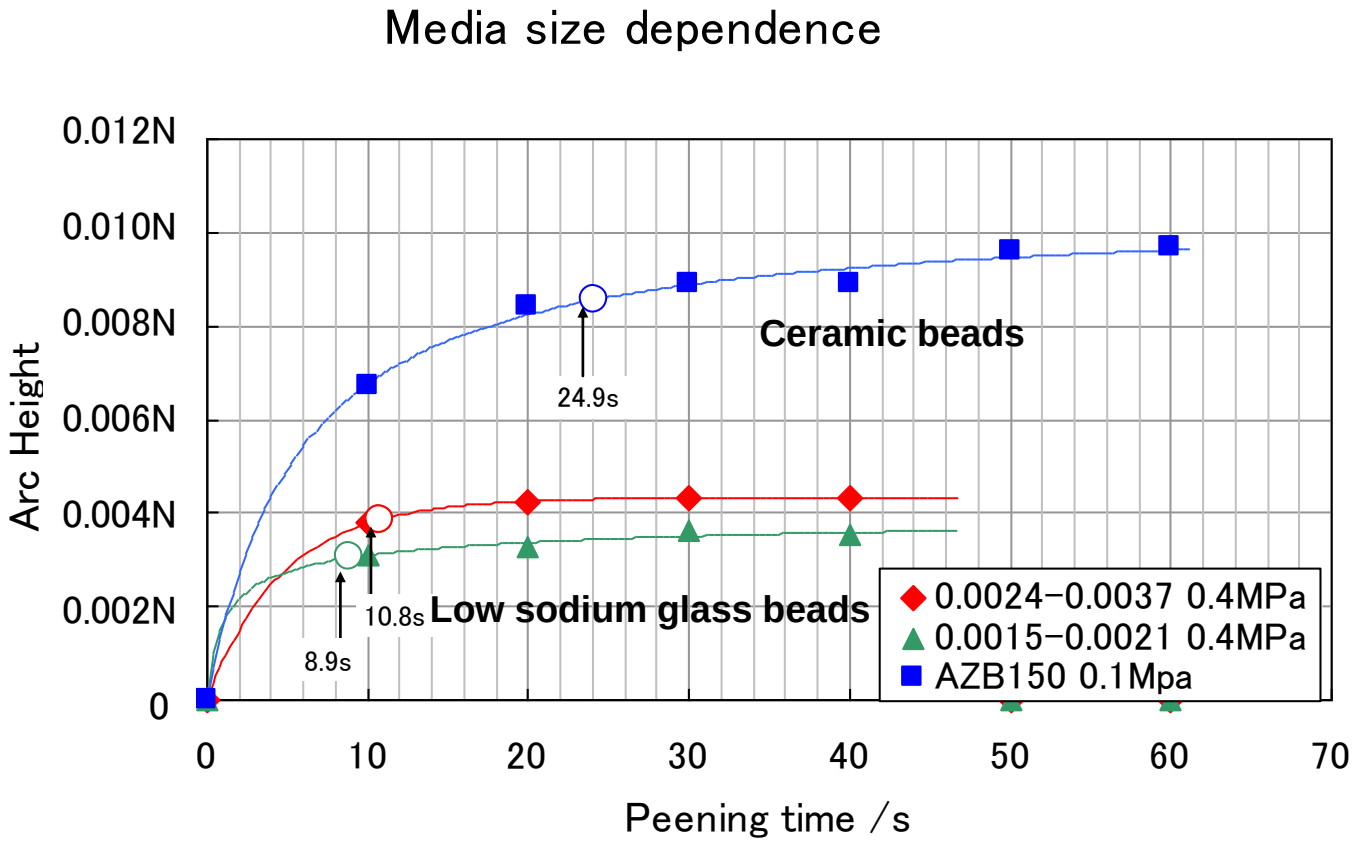
- FPSP=covered with dimples.
- Surface roughness after FPSP is the same or less.
- Residual stress at the surface after FPSP is about 160MPa, while that of SP is about 190MPa.

FPSP using low sodium glass beads leads to

-Good tribological property

-Good fatigue property

FPSP media (Saturation carve)



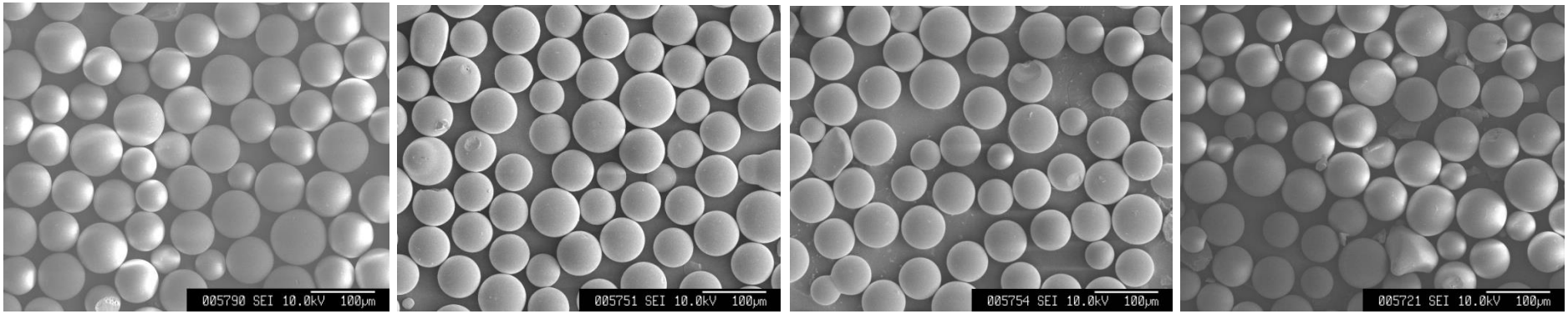
Saturation point for using low sodium glass beads is faster than that of other media unless otherwise required high intensity.

FPSP media (consistency test)

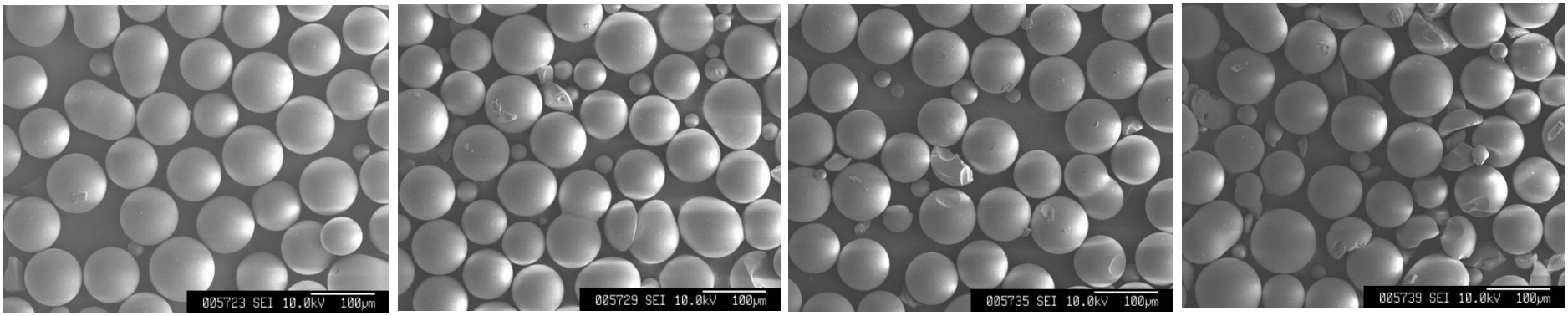
MITSUBISHI HEAVY INDUSTRIES, LTD.

Low sodium glass beads (FC200, 63/90μm)

1 cycles | 5 cycles | 10 cycles | 20 cycles



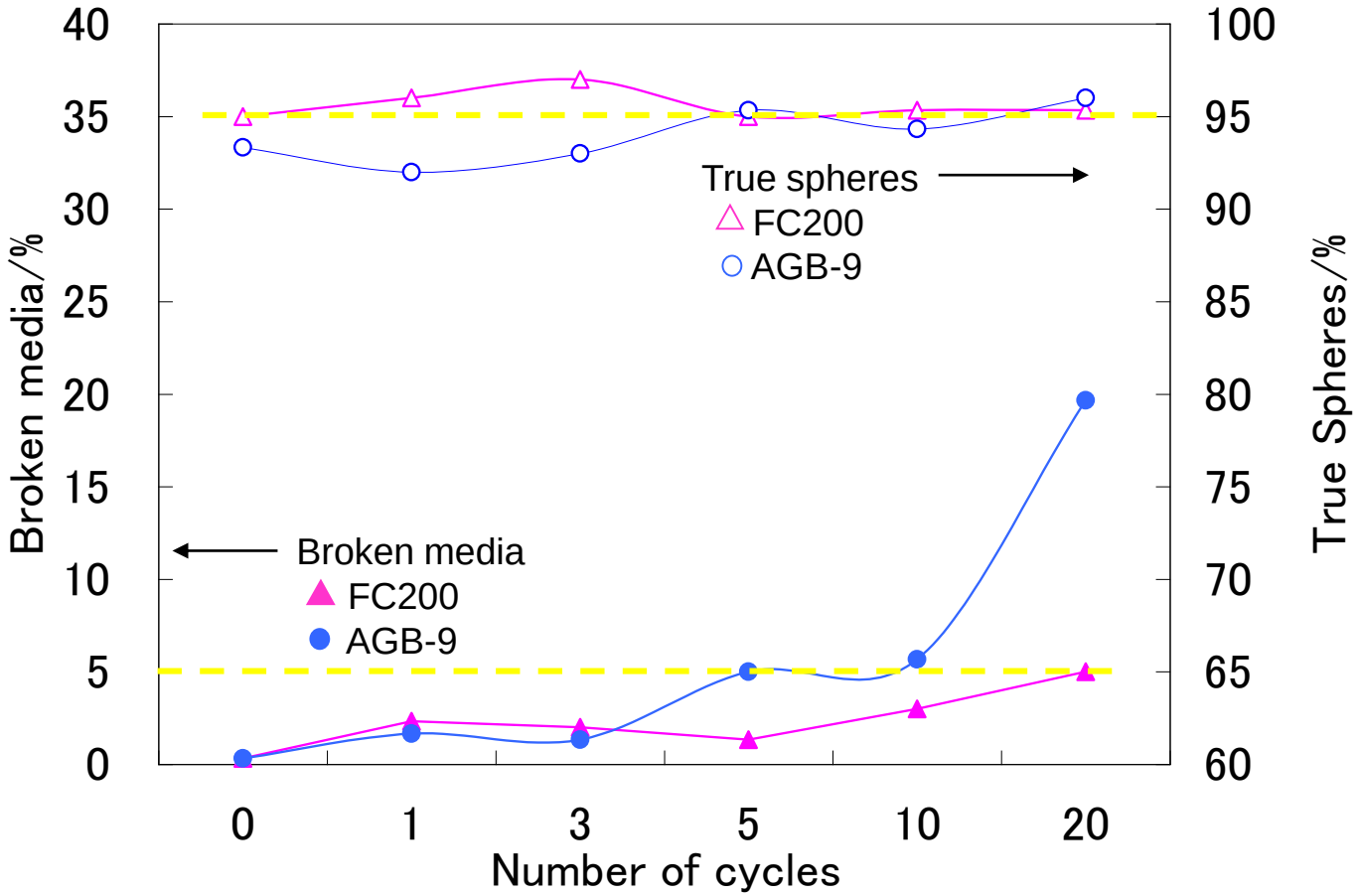
Glass beads (AGB-9)



FC200 are keeping within 5% in broken media even after 20 cycles.
AGB-9 are broken by impact and exceed to 5 % in broken media after 5 cycles.

FPSP machine (suction type),
compressed air 0.25MPa
Al alloy target

FPSP media (consistency test)



Durability comparison

- Low sodium glass beads have less consumption rate than that of glass beads.
- Glass beads do not keep uniform shot flow after 5 cycles.

Summary

- Fine particle shot peening (FPSP) shows good fatigue property due to high compressive stress at very near surface and smooth surface without shot peened flow or machined flow.
- Low Sodium Glass Beads (AMS 2431/10) are suitable size for FPSP.
- shortened peening time and uniform shot flow even small media
- Low sodium glass beads have less consumption rate than that of glass beads.