

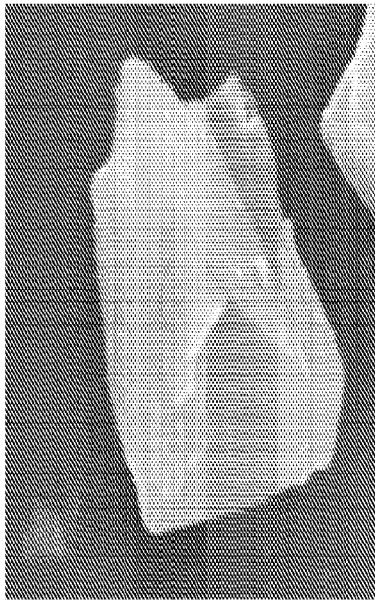


FIG. 1A

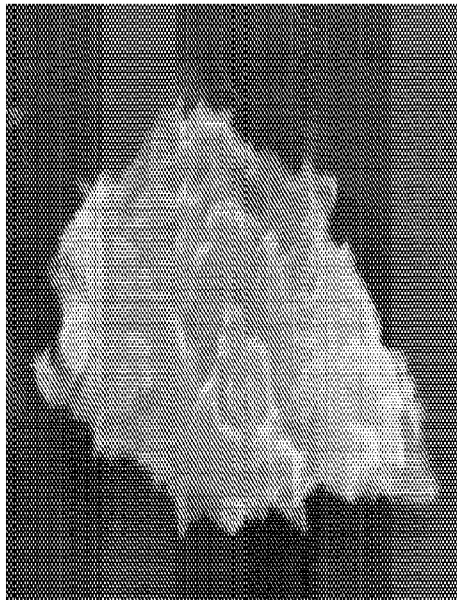


FIG. 1C

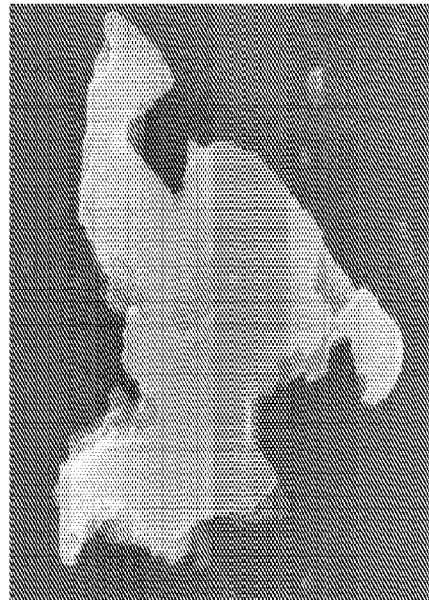


FIG. 1E

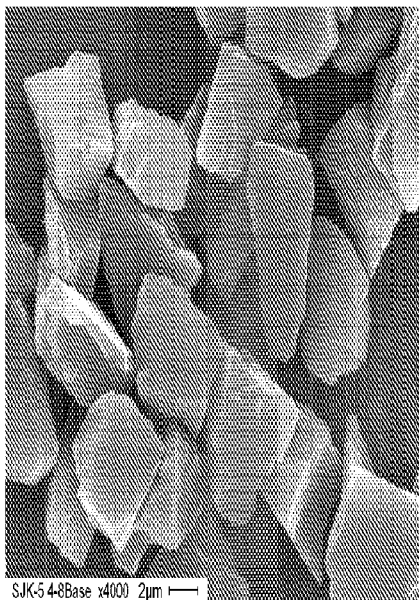


FIG. 1B

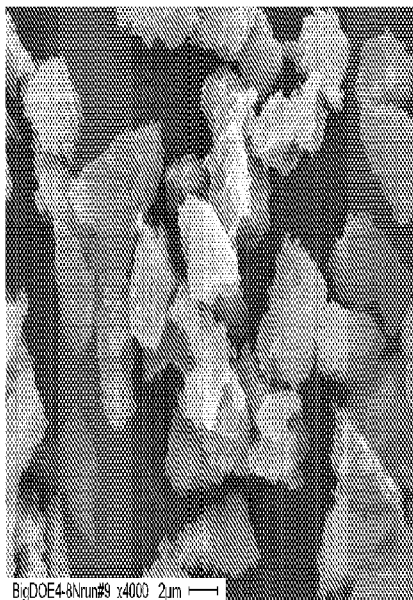


FIG. 1D

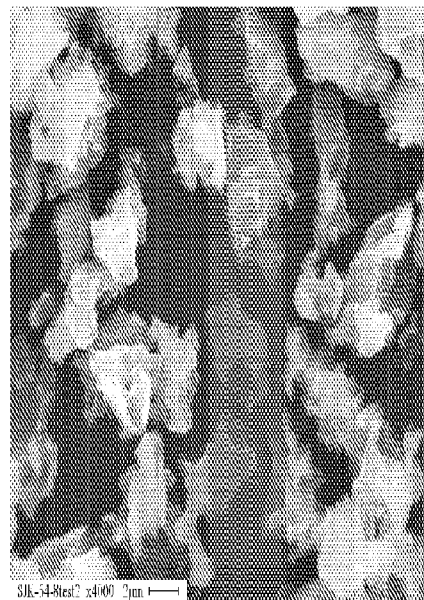


FIG. 1F

FIG. 2

## Physical and Performance Data for 4-8um Diamond Powder

| Sample                    | Weight Loss, % | Powder Mean Size, um | Specific Surface Area m <sup>2</sup> /gram | Material Removal, mg/hr | Clemex, Roughness | Clemex, Sphericity |
|---------------------------|----------------|----------------------|--------------------------------------------|-------------------------|-------------------|--------------------|
| 825C 30% Nickel (DOE #40) | 35             | 5.6                  | 1.29                                       | 279                     | 0.77              | 0.47               |
| 900C 30% Nickel (DOE#9)   | 56             | 5.0                  | 1.55                                       | 304                     | 0.78              | 0.46               |
| Iron-etched SJK-5 4-8um   | 52             | 5.7                  | 1.55                                       | 276                     | 0.68              | 0.34               |
| SJK-5 4-8um Baseline      | -              | 5.7                  | 0.88                                       | 126                     | 0.89              | 0.64               |
| 4-8um Polycrystalline     | -              | 4.7                  | 2.9                                        | 168                     | 0.84              | 0.60               |

FIG. 3

## Roughness Distribution of 4-8um Diamond

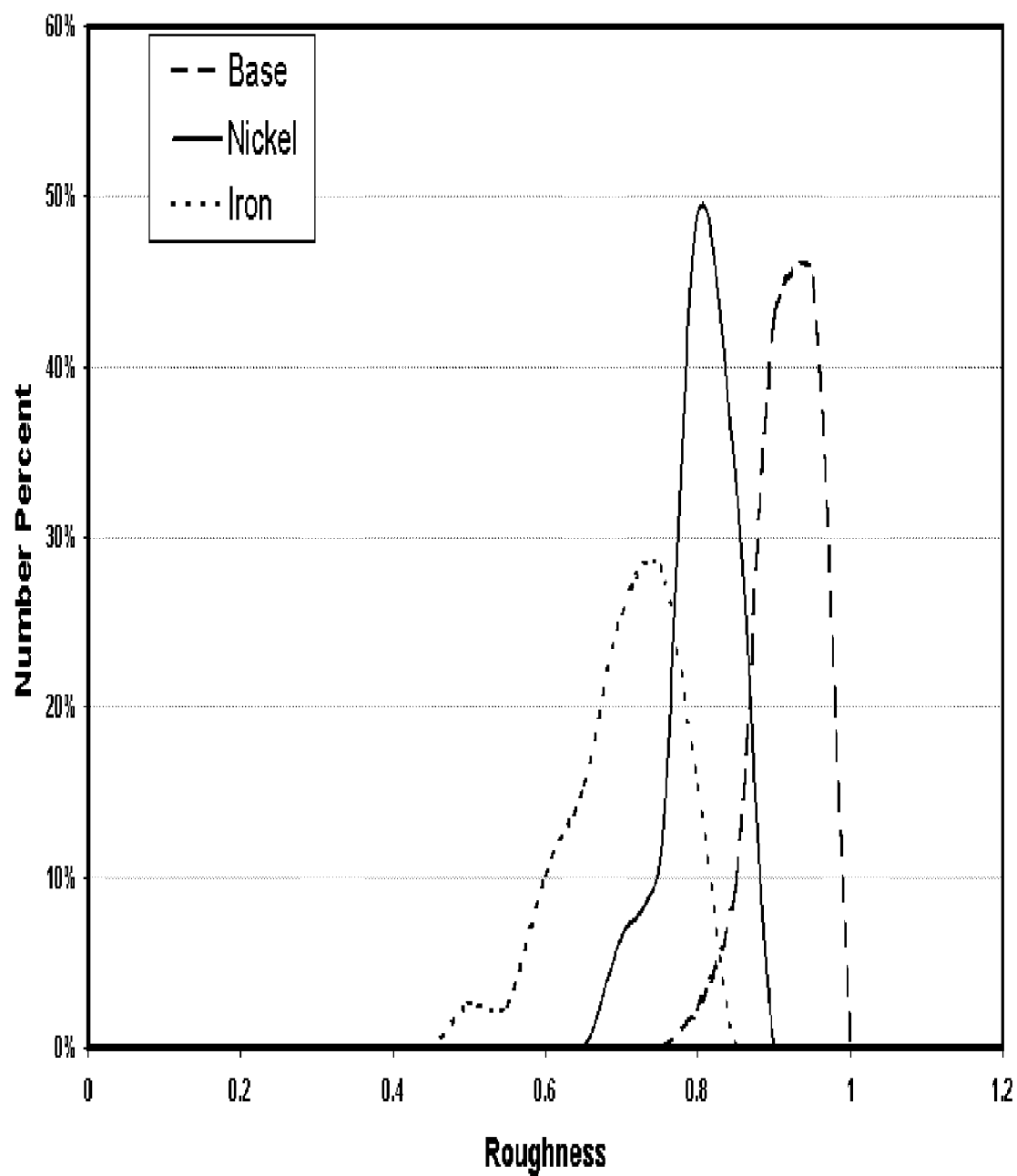


FIG. 4

## Sphericity Distribution of 4-8um Diamond

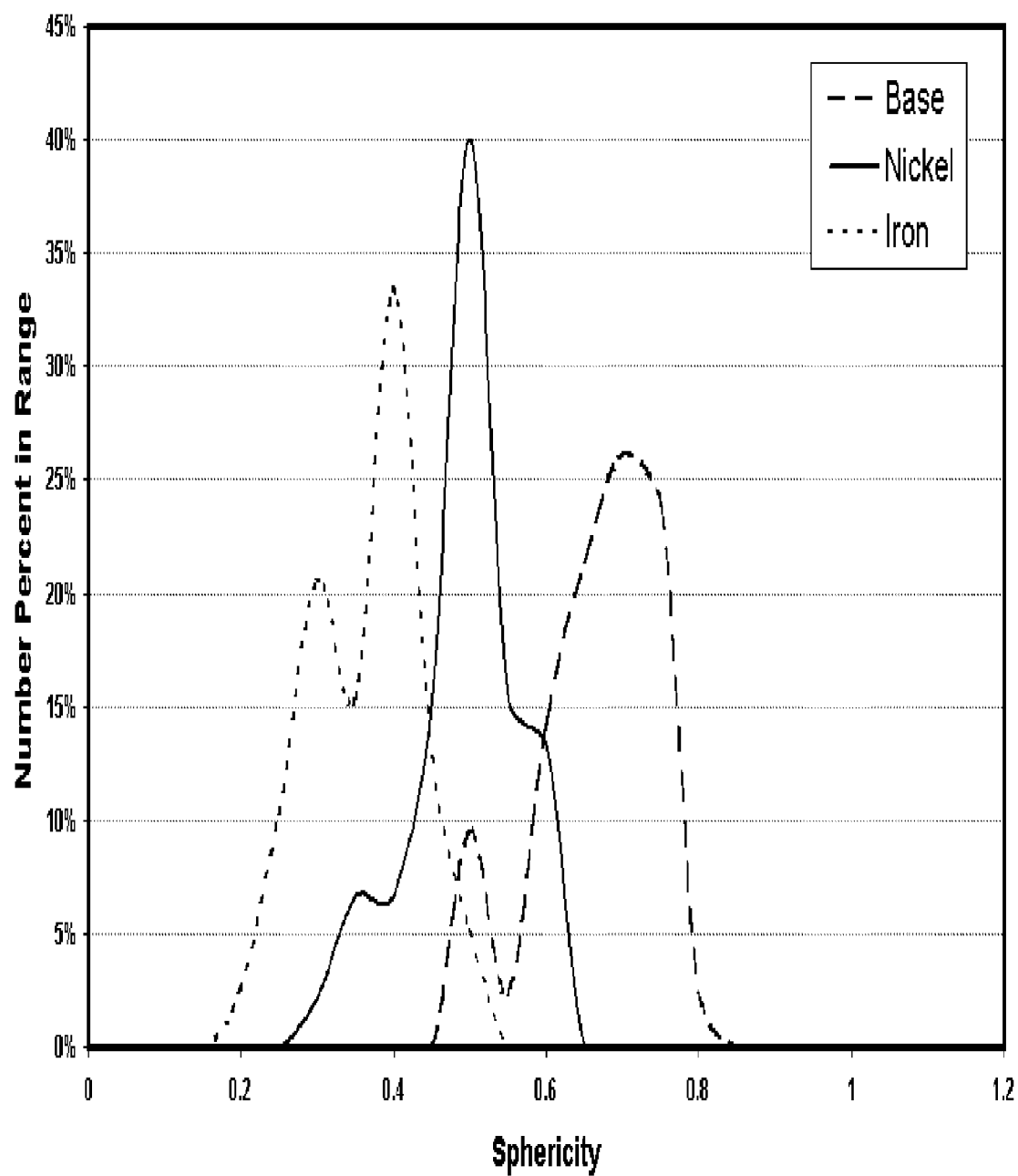
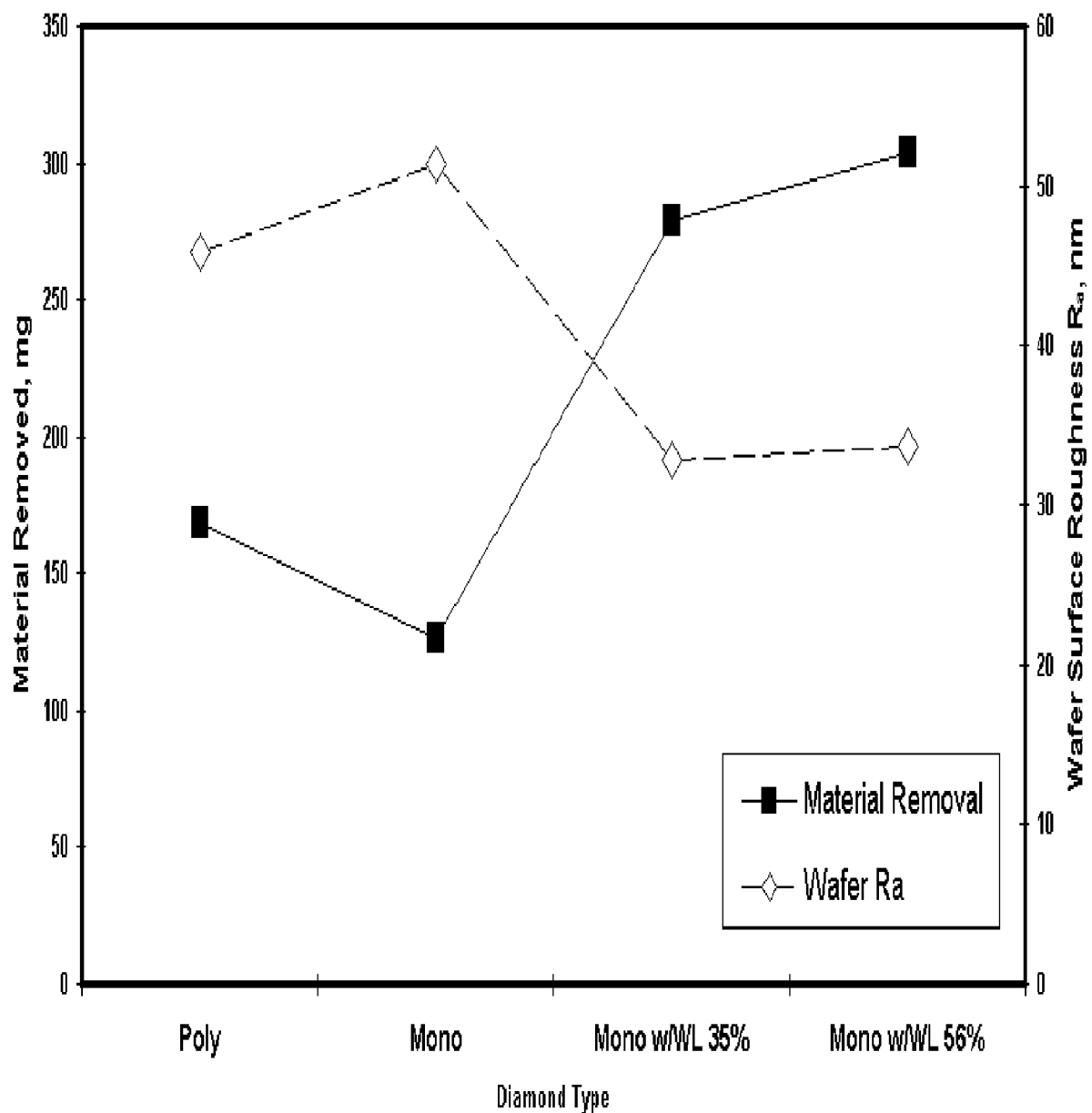


FIG. 5

Comparison of Material Removal and Wafer Surface Roughness Using  
4-8um Diamond Powders in Slurry for Lapping Sapphire Wafers



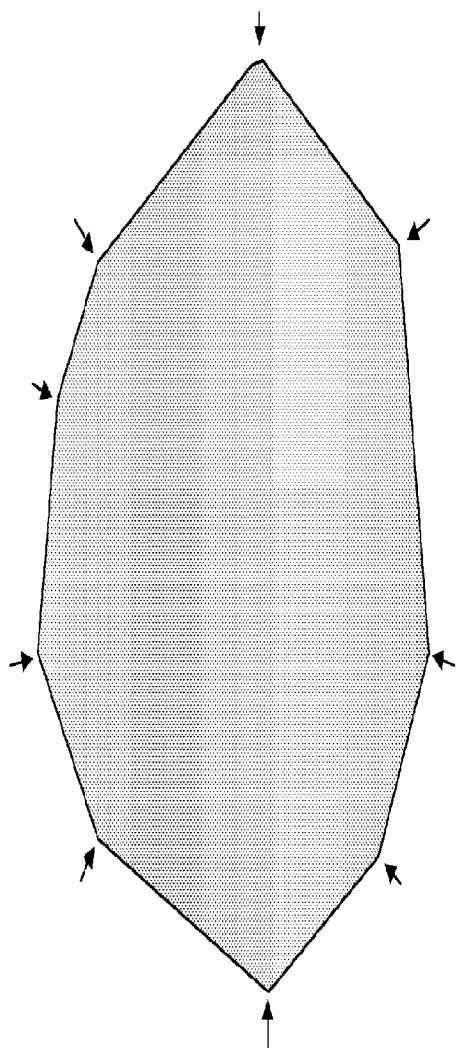


FIG. 6A

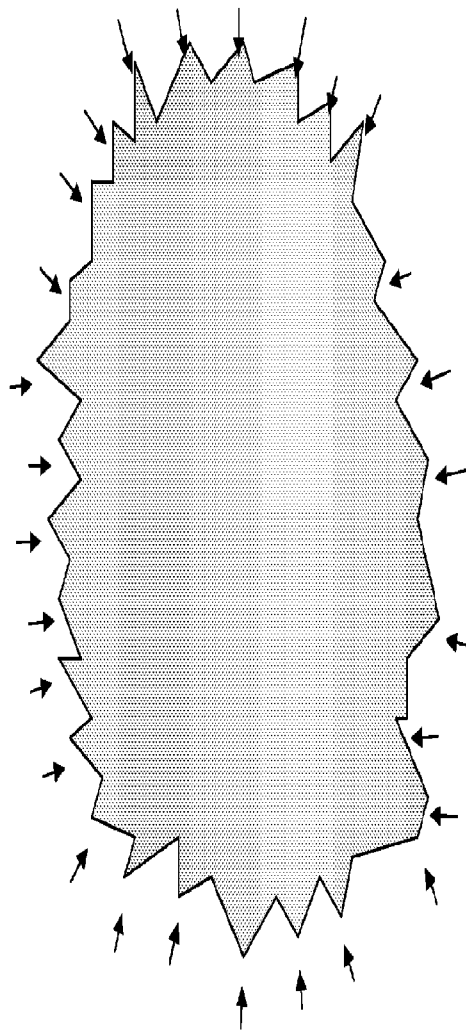


FIG. 6B

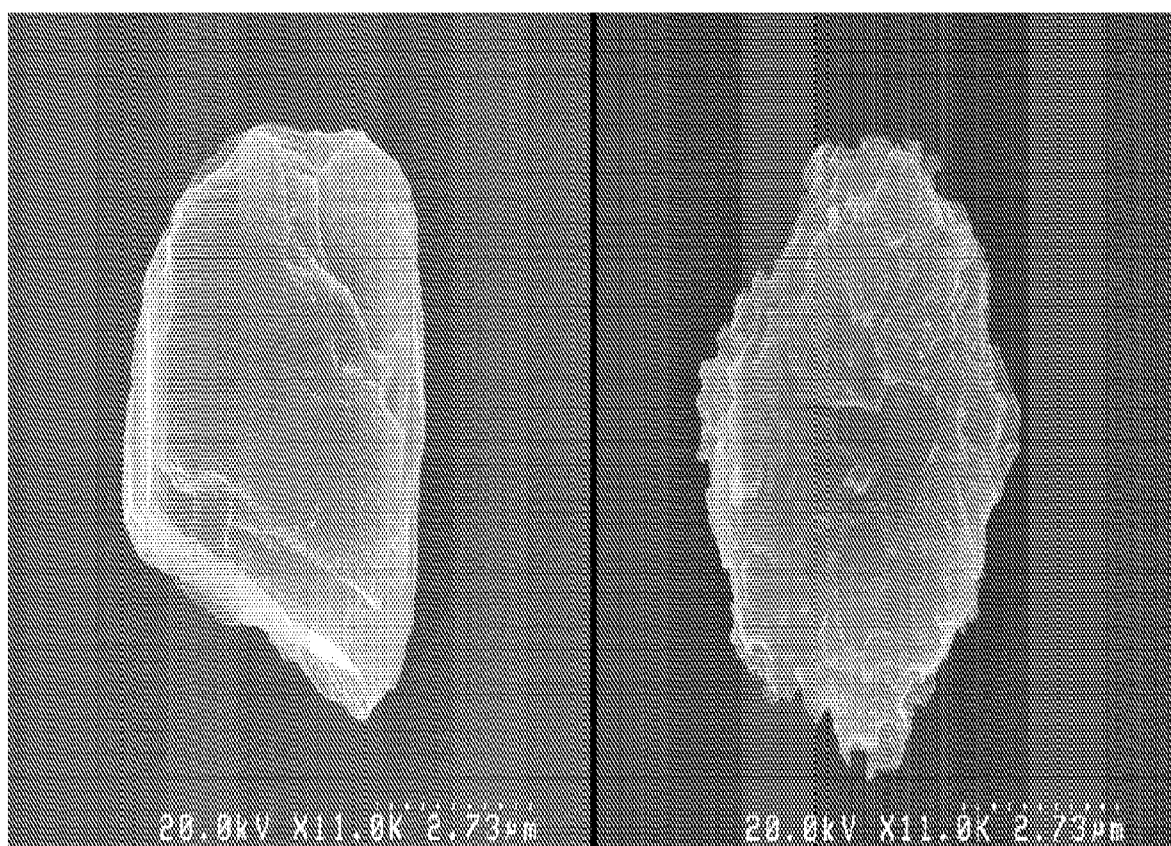


Fig. 7

Fig. 8

Fig. 9A



Fig. 9B

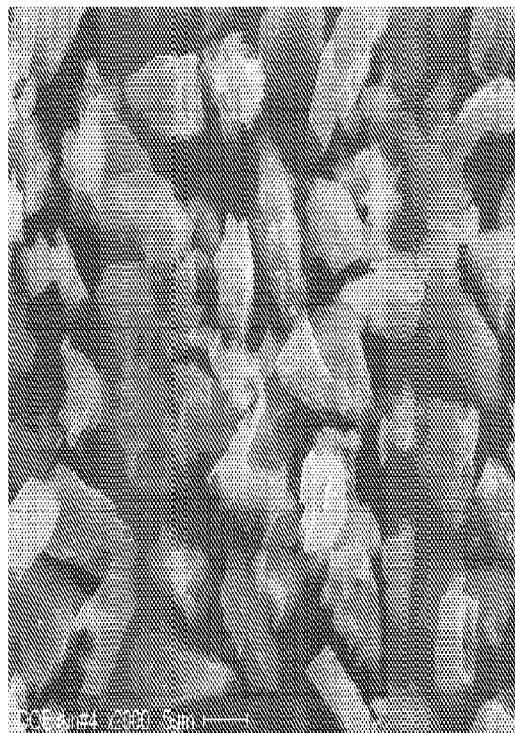


Fig. 9C

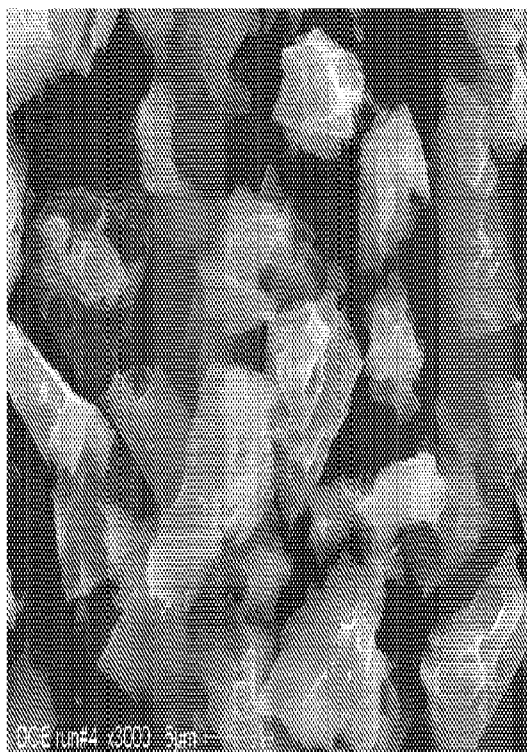


Fig. 9D



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Fig. 10A



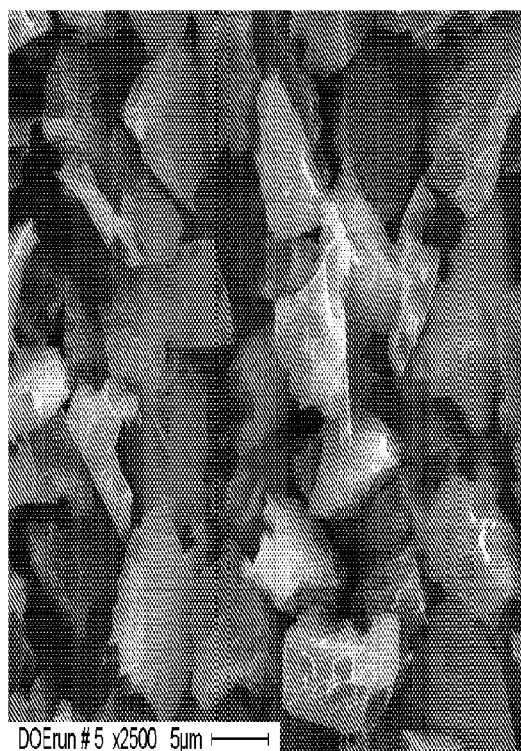
Fig. 10B



Fig. 10C



Fig. 10D



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Fig. 11A



Fig. 11B

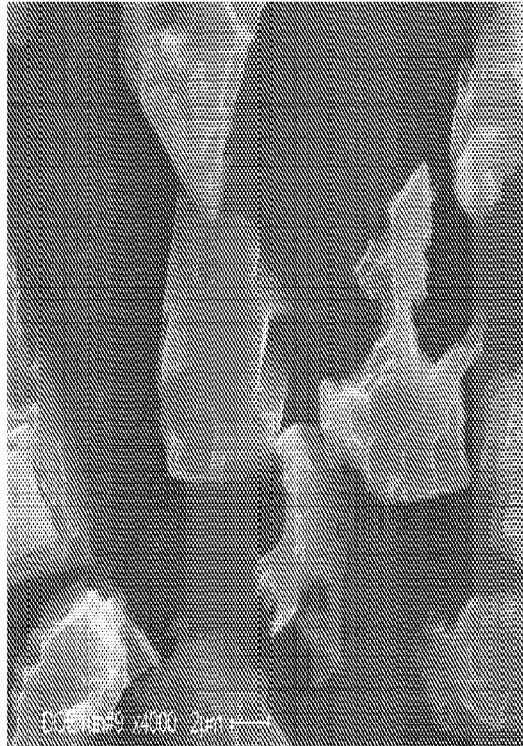


Fig. 11C

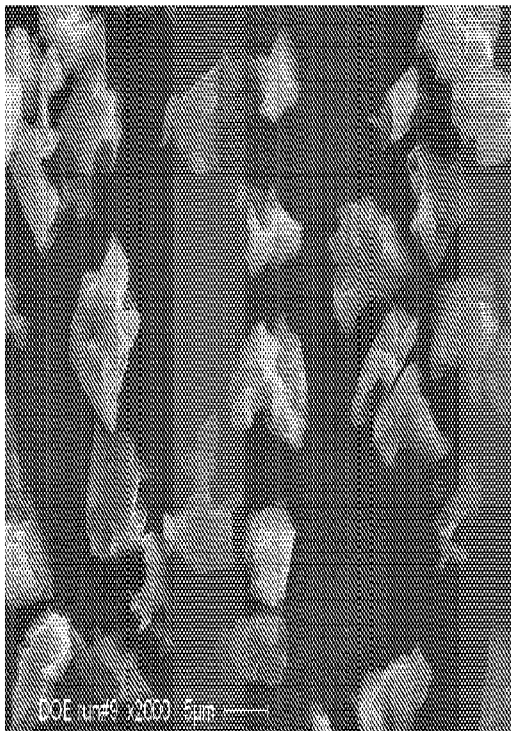
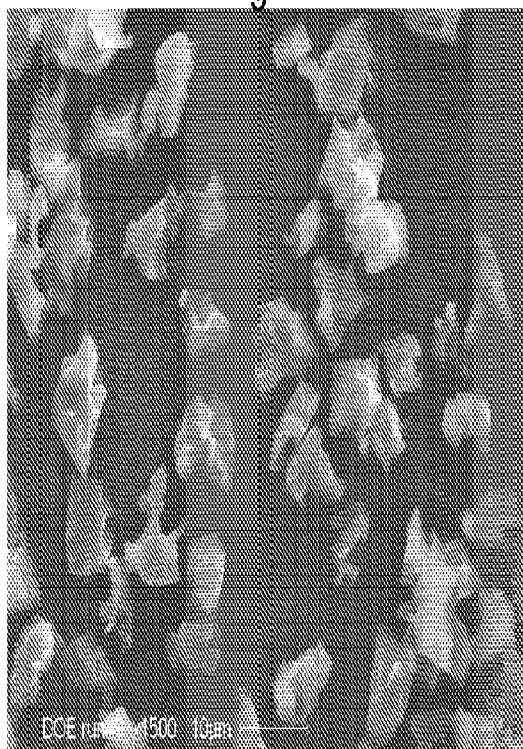


Fig. 11D



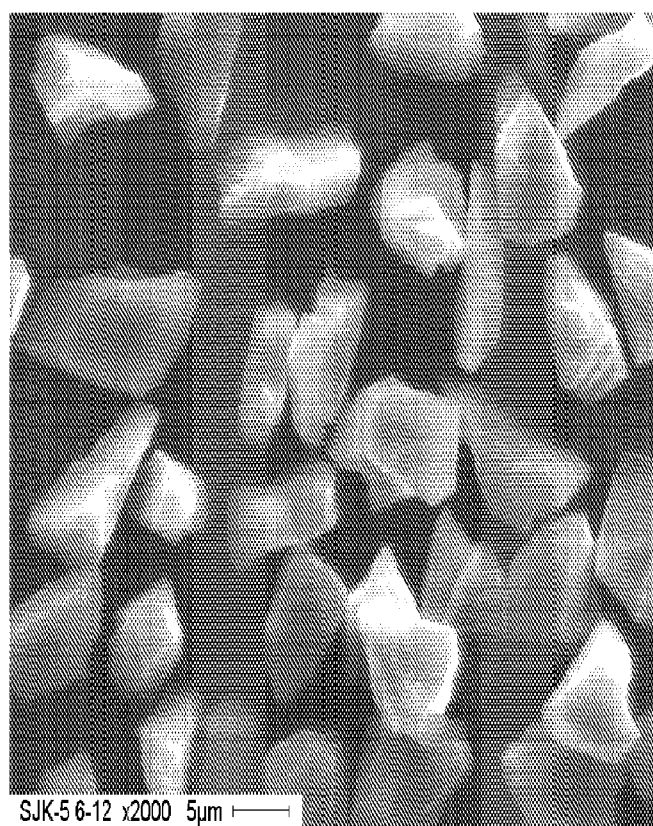


Fig. 12

**Table 2**

| DOE Run#  | Start Size<br>( $\mu\text{m}$ ) | Final Size<br>( $\mu\text{m}$ ) | Diamond<br>Wt % loss | Surface Area<br>( $\text{m}^2/\text{g}$ ) | Material<br>Removal<br>(mg) | Roughness | Sphericity |
|-----------|---------------------------------|---------------------------------|----------------------|-------------------------------------------|-----------------------------|-----------|------------|
| 8         | 9                               | 8.6                             | 15                   | 0.45                                      | 148                         | 0.89      | 0.64       |
| 7         | 9                               | 8.47                            | 23                   | 0.5                                       | 132                         | 0.82      | 0.54       |
| 6         | 9                               | 8.56                            | 25                   | 0.53                                      | 146                         | 0.79      | 0.5        |
| 3         | 9                               | 8.74                            | 30                   | 0.62                                      | 150                         | 0.79      | 0.48       |
| 11        | 9                               | 8.57                            | 36                   | 0.48                                      | 160                         | 0.84      | 0.56       |
| 5         | 9                               | 7.72                            | 45                   | 0.76                                      | 191                         | 0.67      | 0.34       |
| 9         | 9                               | 7.87                            | 53                   | 0.78                                      | 179                         | 0.62      | 0.26       |
| 4         | 9                               | 7.83                            | 61                   | 0.88                                      | 207                         | 0.69      | 0.34       |
| Reference | Mono                            | 8.69                            | ---                  | 0.55                                      | 115                         | 0.92      | 0.69       |
| Reference | POLY                            | 8.07                            | ---                  | 1.7                                       | 250                         | 0.83      | 0.6        |

**FIG. 13**

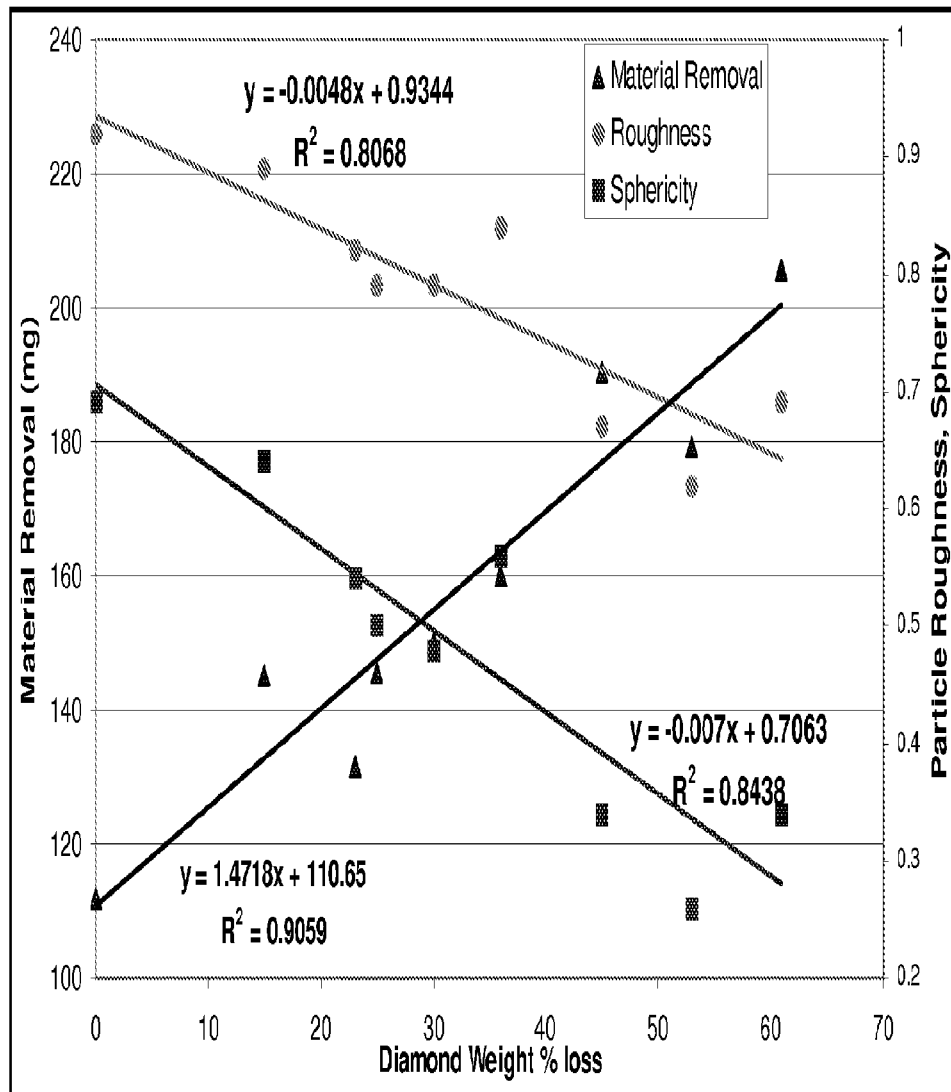


Fig. 14

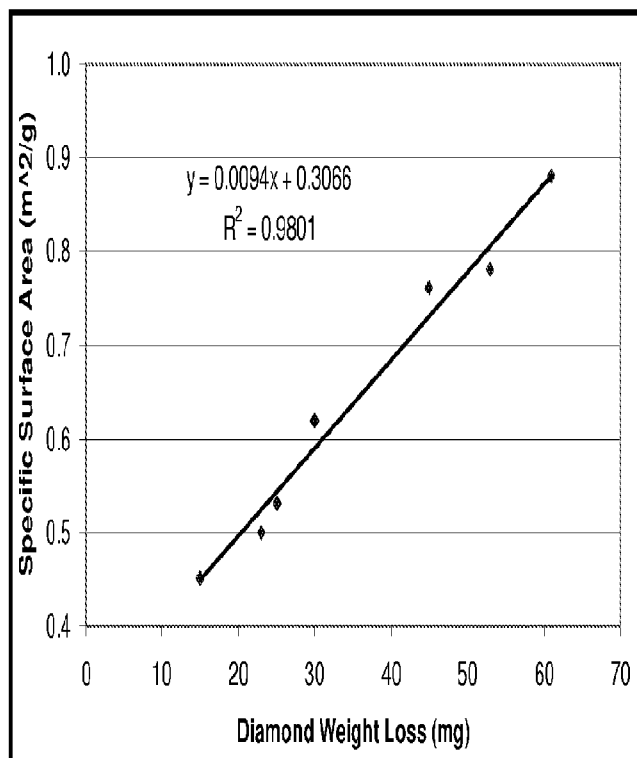


Fig. 15

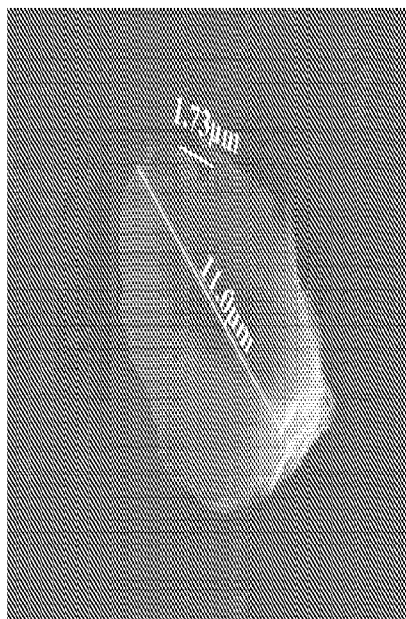


Fig. 16

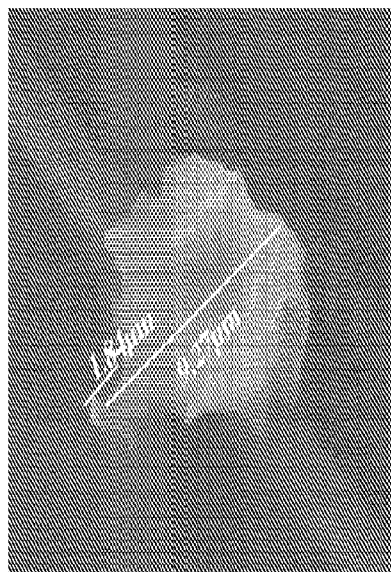


Fig. 17

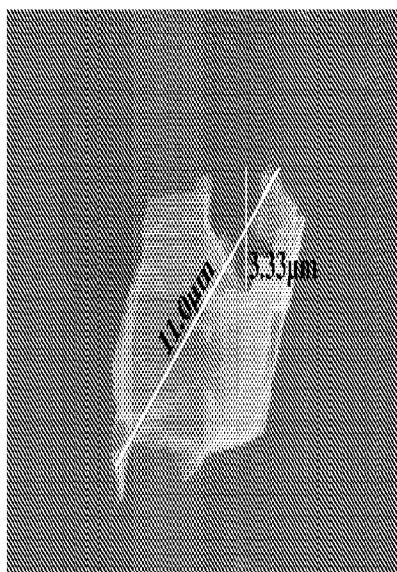


Fig. 18

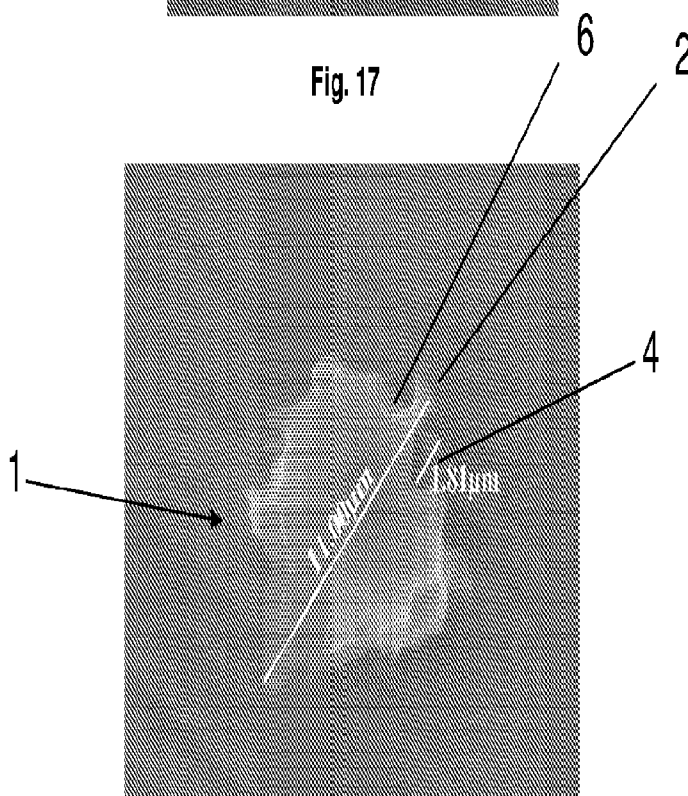


Fig. 19

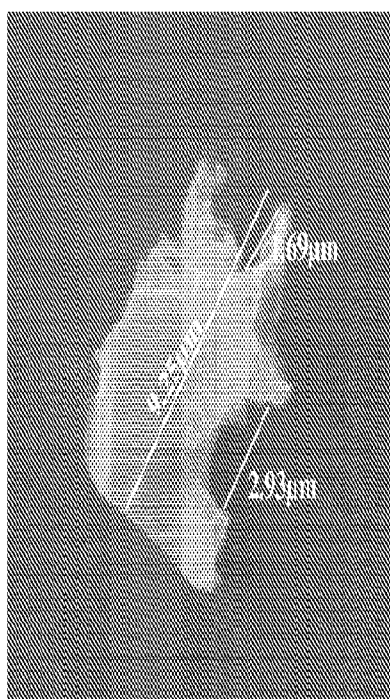


Fig. 20

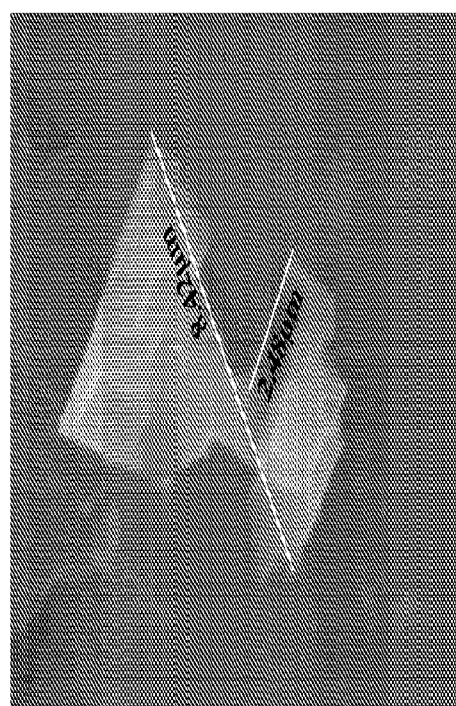


Fig. 21

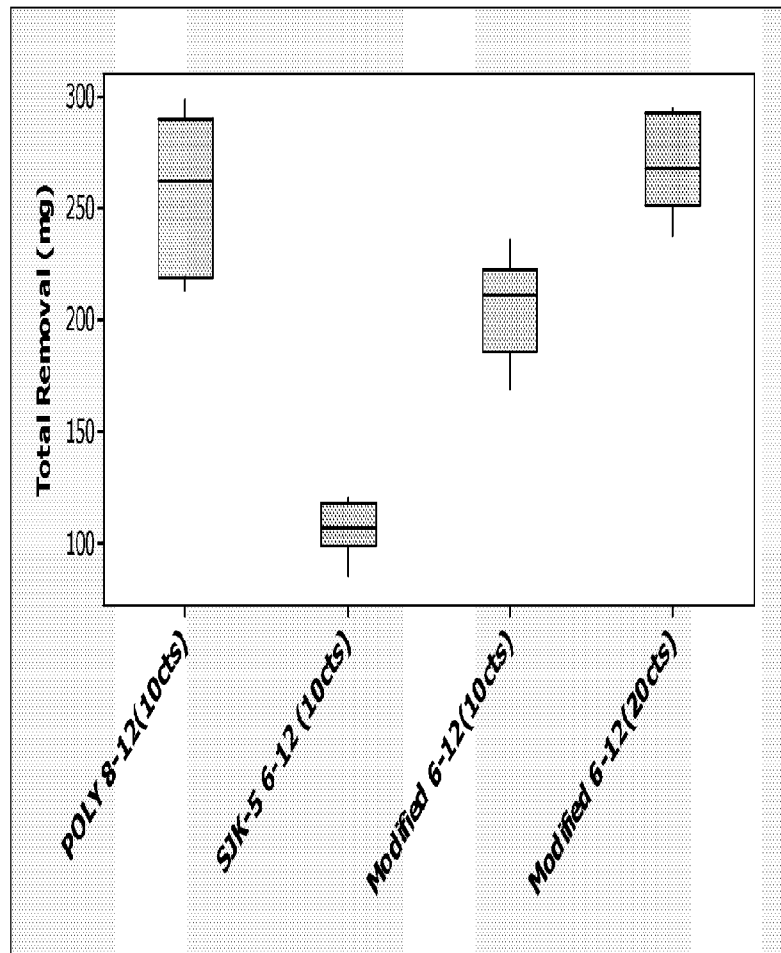


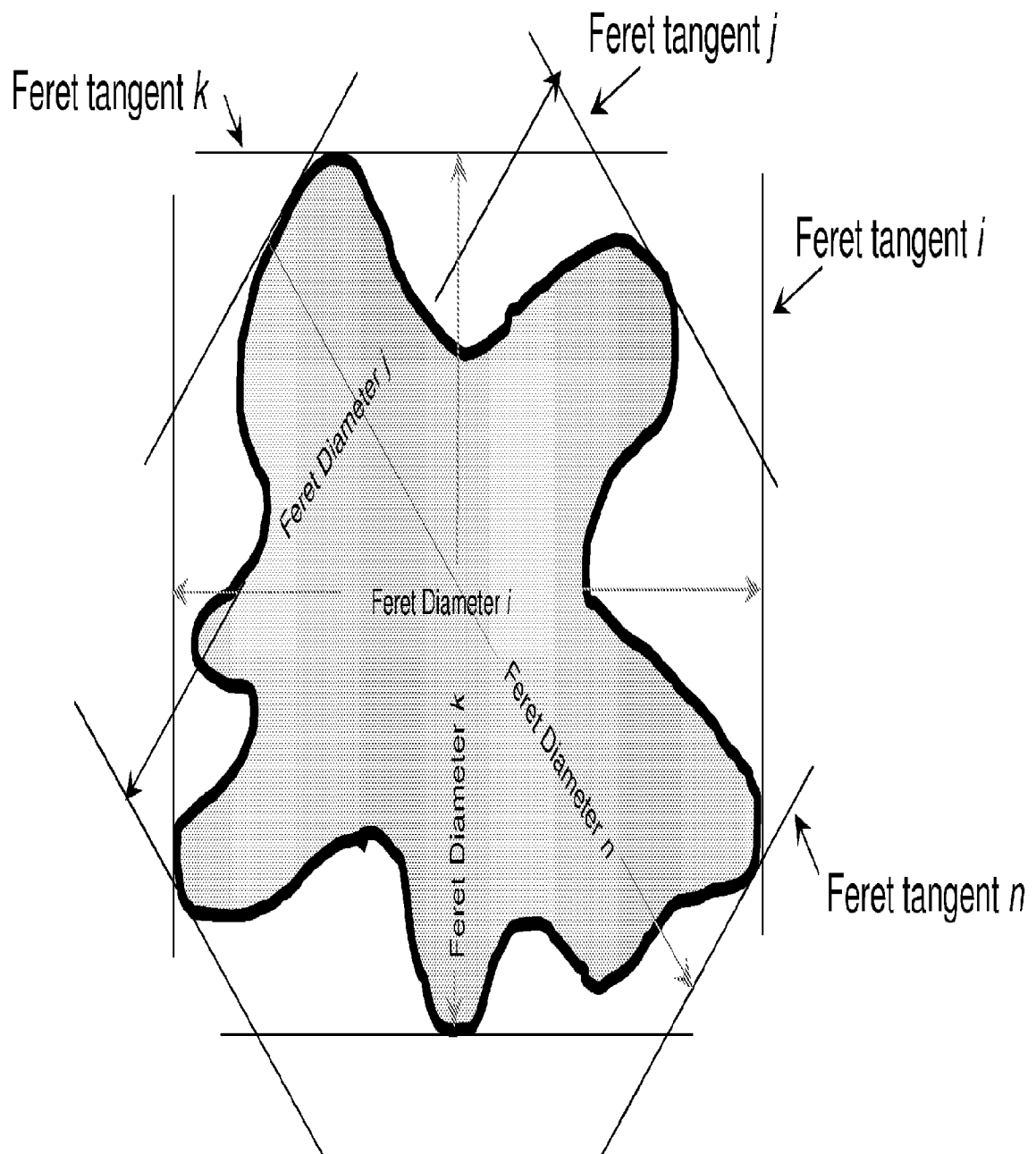
Fig. 22

**Table 3**

| Run # | Temperature (°C) | Time (hr) | Iron % (by wt) | Diamond % (by wt) | Diamond wt% loss |
|-------|------------------|-----------|----------------|-------------------|------------------|
| 8     | 750              | 1         | 60             | 40                | 15               |
| 7     | 750              | 2         | 60             | 40                | 23               |
| 6     | 750              | 1         | 80             | 20                | 25               |
| 3     | 850              | 1         | 60             | 40                | 30               |
| 11    | 750              | 2         | 80             | 20                | 36               |
| 5     | 850              | 1         | 80             | 20                | 45               |
| 9     | 850              | 2         | 60             | 40                | 53               |

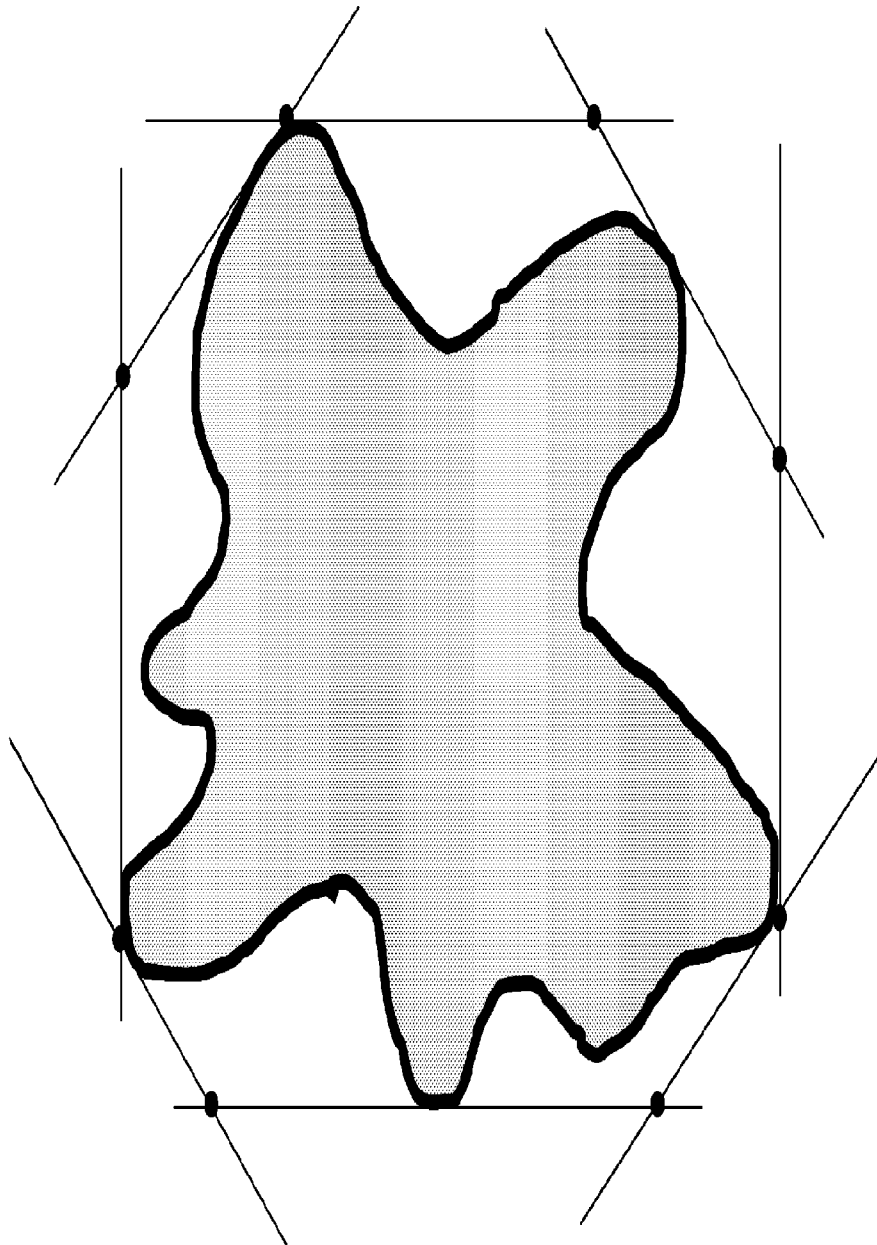
**Fig. 23**

Fig. 24



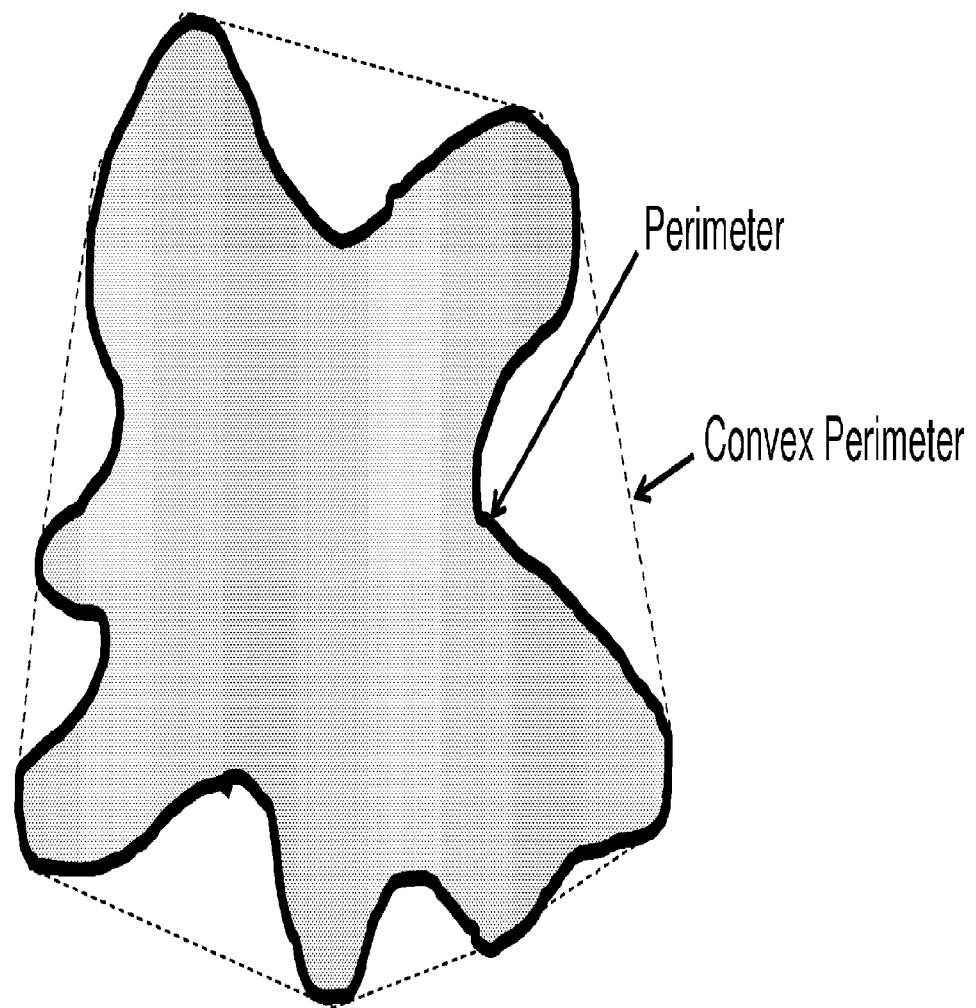
Feret diameter is defined as the distance between two parallel lines touching the boundary of a 2-dimensional image or particle profile.

Fig. 25



The convex perimeter is formed from the intersection of many feret tangent lines.

Fig. 26



$$\text{Convex perimeter} = \sum \text{Ferets } (2 \tan) \times \left( \frac{\pi}{2(\text{number of ferets})} \right)$$

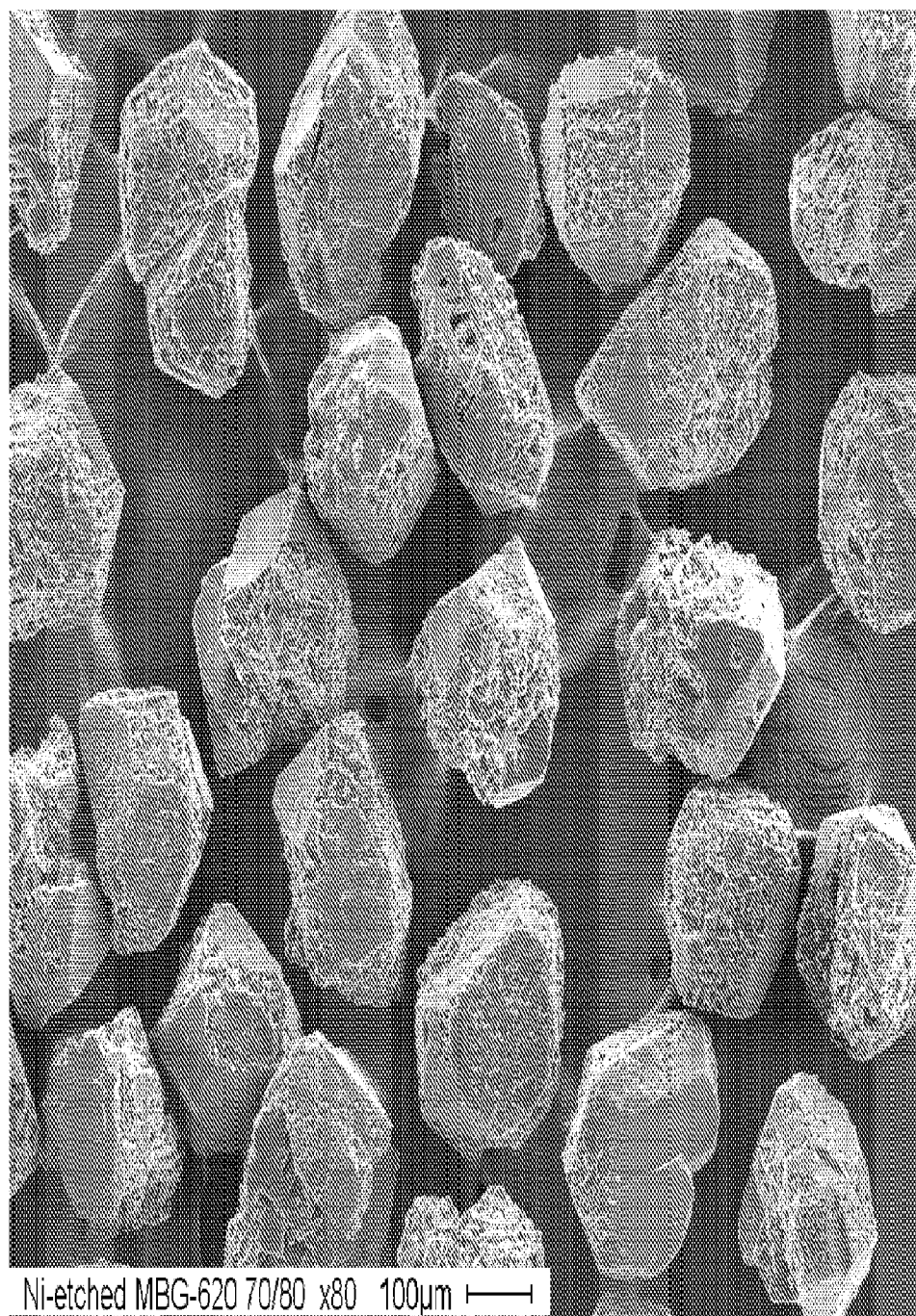


Fig. 27A

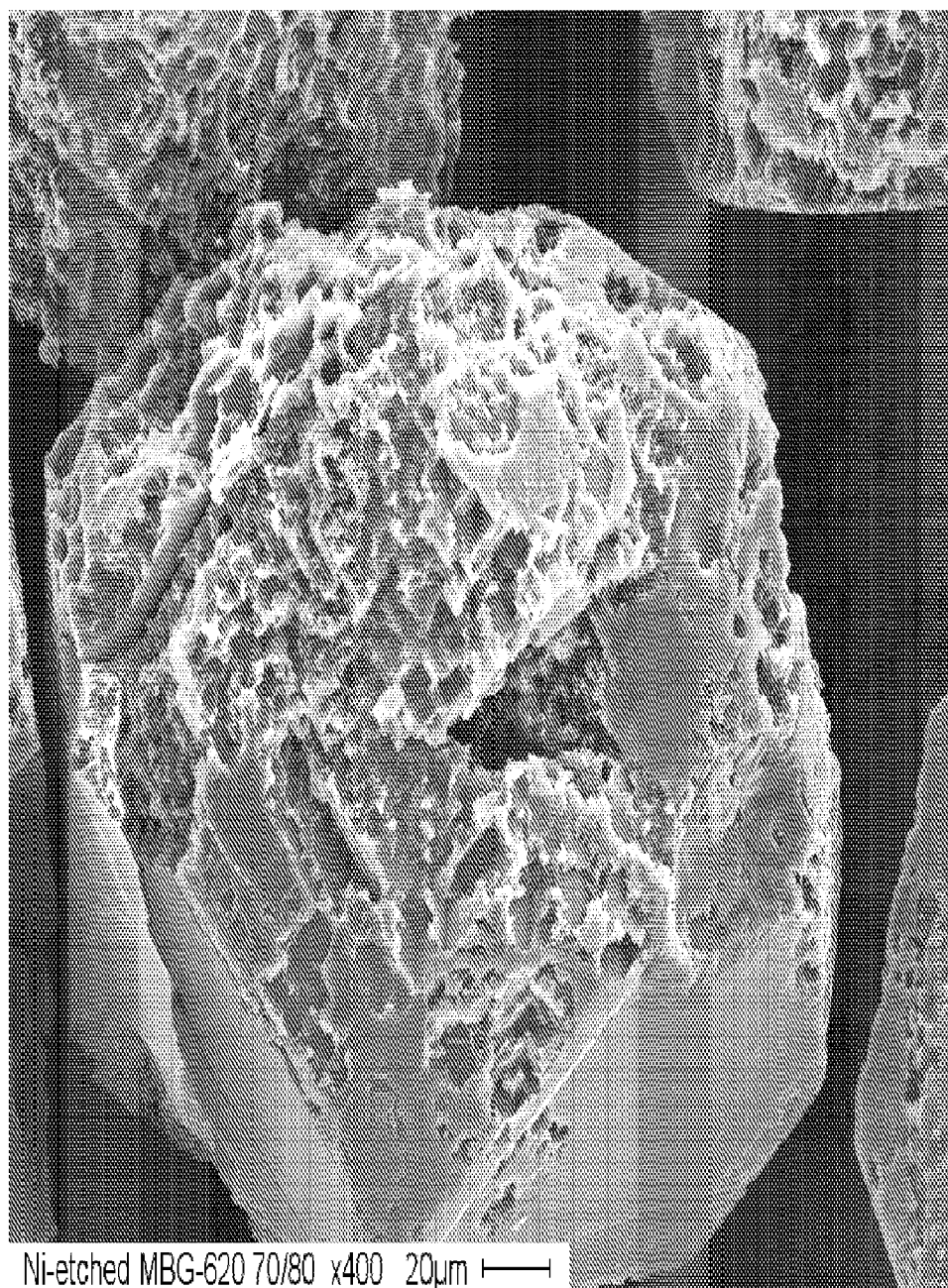


Fig. 27B