**Table 1. Formulation details of Propellant Compositions**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr.  No. | Ingredients | Reference  Composition | Developed Compositions | | | |
| Comp. 1 | Comp. 2 | Comp. 3 | Comp. 4 |
| 1. | Binder (HTPB+TDI+DOA) | 14.00 % | 14.00 % | 14.00 % | 14.00 % | 14.00 % |
| 2. | AP Coarse(300 µm) | 52.50 % | 52.25 % | 52.00 % | 51.75 % | 51.50 % |
| 3. | AP Fine (50 µm) | 15.50% | 15.50% | 15.50% | 15.50% | 15.50% |
| 4. | Al(P) | 18.00 % | 18.00 % | 18.00 % | 18.00 % | 18.00 % |
| 5. | Nano Cr2O3 / micron Cr2O3 | 0.00 % | 0.25 % | 0.50 % | 0.75 % | 1.00 % |

**Table 2. Effect of nano and micron sized Cr2O3 on viscosity andmechanical properties**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sr. No. | Composition | viscosity@ 40 °C (Pa.s) | TS  (MPa) | E-Mod  (MPa) | Elongation  (%) |
| 1 | Reference | 670 | 0.62 | 3.43 | 45.00 |
| 2 | Nano Cr2O3, 0.25% | 712 | 0.78 | 4.03 | 40.20 |
| 3 | Nano Cr2O3,0.50% | 740 | 0.84 | 4.24 | 35.27 |
| 4 | Nano Cr2O3, 0.75% | 765 | 0.90 | 4.63 | 30.24 |
| 5 | Nano Cr2O3,1.00% | 797 | 0.93 | 5.07 | 27.71 |
| 6 | Micron Cr2O3,0.25% | 704 | 0.76 | 3.73 | 42.11 |
| 7 | Micron Cr2O3,0.50% | 722 | 0.83 | 4.13 | 37.42 |
| 8 | Micron Cr2O3,0.75% | 745 | 0.87 | 4.49 | 33.69 |
| 9 | Micron Cr2O3,1.00% | 757 | 0.91 | 4.81 | 30.03 |

**Table 3.Effect of nano and micron sized Cr2O3 on ballistic properties**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sl. No. | Composition | Solid strand burning rate (SSBR) at MPa (mm/s) | | | Density  (kg/m3) | Pressure  Exponent  (n) | Cal-Val  (kJ /kg) |
| 5.88 | 6.86 | 7.84 |
| 1 | Reference | 6.00 | 6.11 | 6.55 | 1777 | 0.35 | 6489.54 |
| 2 | Nano Cr2O3,0.25% | 7.16 | 7.55 | 8.00 | 1777 | 0.38 | 6451.86 |
| 3 | Nano Cr2O3,0.50% | 7.19 | 7.59 | 8.11 | 1778 | 0.42 | 6430.92 |
| 4 | Nano Cr2O3,0.75% | 7.20 | 7.72 | 8.30 | 1782 | 0.49 | 6384.87 |
| 5 | Nano Cr2O3,1.00% | 7.22 | 7.88 | 8.40 | 1783 | 0.53 | 6368.12 |
| 6 | MicronCr2O3,0.25% | 7.13 | 7.46 | 7.94 | 1777 | 0.37 | 6447.67 |
| 7 | Micron Cr2O3,0.50% | 7.15 | 7.48 | 8.00 | 1779 | 0.39 | 6418.36 |
| 8 | Micron Cr2O3,0.75% | 7.19 | 7.61 | 8.20 | 1780 | 0.45 | 6380.68 |
| 9 | Micron Cr2O3,1.00% | 7.20 | 7.66 | 8.26 | 1781 | 0.48 | 6359.75 |