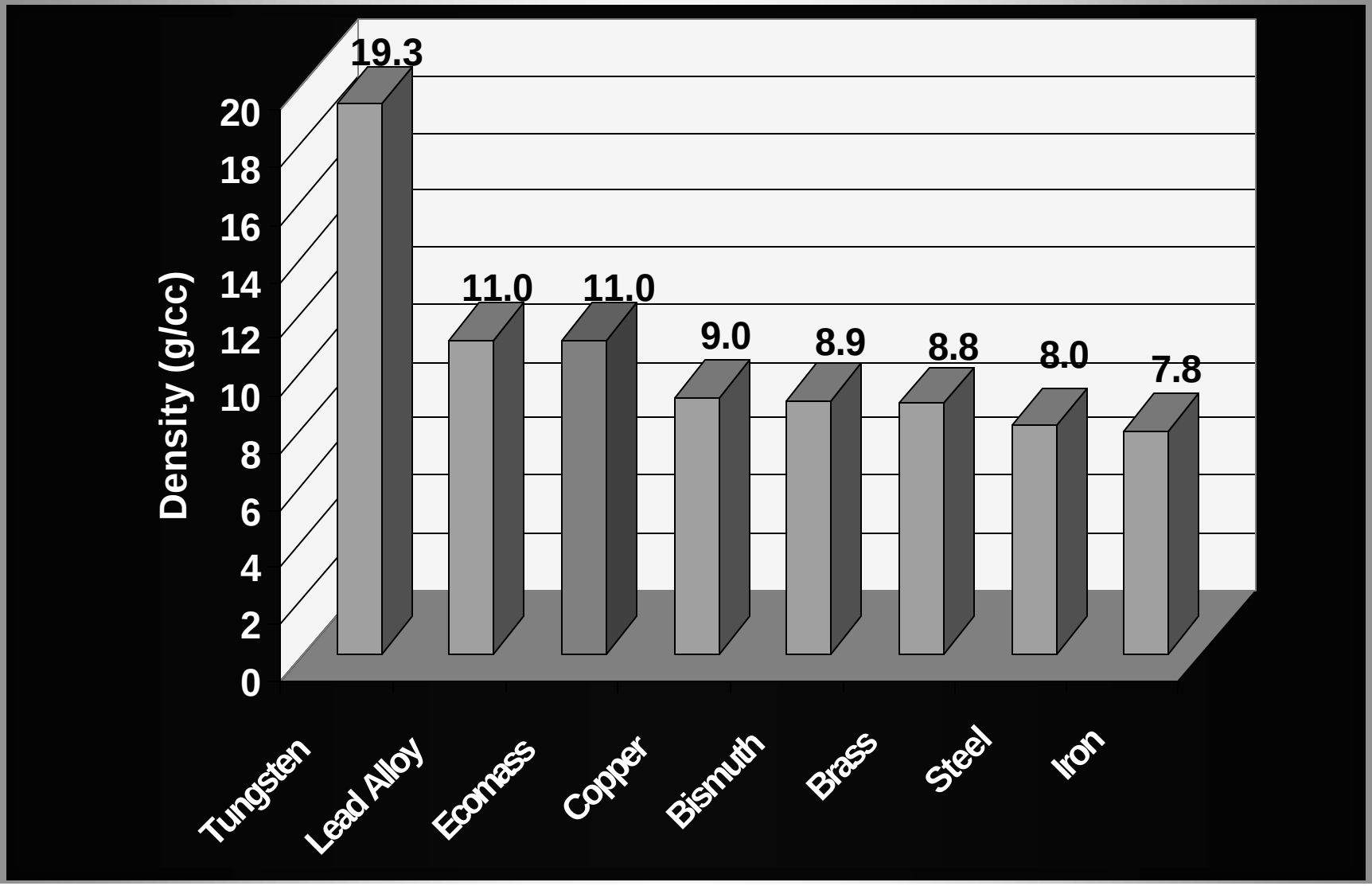
New Composite Material Technology

- ✓ Primary Development Objectives:
  - ➔ Nontoxic Material (DoD, EPA)
  - ➔ Achieve Key Characteristics of Lead
    - ➢ Density of 11.0 g/cc
    - ➢ Ease of Processing
  - ➔ Achieve Same Level of Ballistic Performance as Lead Projectile Cores
- ✓ Development of Tungsten / Nylon Thermoplastic Composite Material

Polymers and Fillers

- ✓ Base Polymer - (Nylon, PE, PPS, PEEK, TPE)
- ✓ Fillers - Type & Load Levels
  - ➔ Tungsten (W)
    - ➢ Inert Metal Powder
    - ➢ Melting Point: 3,400º C
    - ➢ Density: 19.3 g/cc
- ✓ Performance Attributes / Properties
  - ➔ Density
  - ➔ Tensile Strength
  - ➔ Impact Strength

Properties - Density Comparison



Properties - Ecomass® Compounds

Property (Test)	Units	NJ-84TP	NJ-90TP	NJ-94TP	NJ-96TP
Filler	%	84	90	94	96
Density	g/cc	5.0	7.0	9.0	11.0
Flexural Modulus	MPa	3,000	3,100	4,310	8,410
Tensile Strength	MPa	50	50	52	52
Ultimate Elongation	%	4.5	3.0	2.0	<1.0
Notched Izod Impact	J/m	58.8	58.8	69.5	77.5
Deflection Temp. 1.8 MPa	°C	147	149	155	155
Linear Mold Shrinkage	mm/mm	0.254	0.229	0.155	0.155

Applications

- ✓ Military Ammunition
  - ➔ 5.56mm ball (M855) and tracer (M856)
  - ➔ 7.62mm ball (M80) and tracer (M62)
  - ➔ 9mm
- ✓ Law Enforcement
- ✓ Civilian Ammunition
- ✓ Shotshell Shot

Conclusions

- ✓ New Line of Composite Materials
  - ➔ Nontoxic
  - ➔ Thermoplastic Based
  - ➔ Wide Range of Binder Options
  - ➔ Injection Moldable
  - ➔ Increased Part Design Flexibility
  - ➔ Performance Parameters Similar to Lead
- ✓ Lead Replacement for Various Applications
  - ➔ Projectiles and Shot
  - ➔ Radiation Shielding