Machining Inconel—especially grades like Inconel 625 or 718—can yield excellent surface finishes, but it depends on the machining method, tooling, speeds/feeds, and whether a finishing pass is applied.

**Typical Surface Finish Values for Inconel (Measured in Ra, µm / µin):**

| Machining Method | Typical Ra (µm) | Ra (µin) |
|---|---|---|
| Rough Turning/Milling | 1.6 - 3.2 | 63 - 125 |
| Semi-Finish Turning | 0.8 - 1.6 | 32 - 63 |
| Finish Turning (Carbide Tool) | 4 - 0.8 | 16 - 32 |
| Fine Grinding | 0.1 - 0.4 | 4 - 16 |
| Honing / Lapping | <0.05 | <2 |

**Notes for Inconel Machining:**

- Inconel is notoriously tough due to its work-hardening nature and low thermal conductivity.
- To achieve Ra < 1.6 µm (63 µin), you'll often need:
    - Sharp carbide or ceramic tooling
    - Low feed rates and shallow depths of cut
    - Ample coolant or high-pressure coolant
- Finishing techniques like grinding, honing, or polishing are often used to meet aerospace or sealing surface requirements (Ra < 0.4 µm / 16 µin).
- Post-machining lapping can reach mirror finishes of 0.025 µm (1 µin) or better, especially for valves or sealing faces.

| Method | Typical Ra (µm) | Typical Ra (µin) | Key Notes |
|---|---|---|---|
| As-printed (LPBF) | 8 - 15 | 315 - 590 | Depends on orientation, layer thickness, powder size. |
| Machined Finish (Turning/Milling) | 0.4 - 1.6 | 16 - 63 | Achievable with carbide tooling & optimized parameters. |
| Fine Grinding / Honing | <0.2 | <8 | Aerospace-grade sealing surfaces; slow & costly. |
| AM Solutions: Standard Vibratory Finish | 3 - 5 | 120 - 200 | Entry-level smoothing with ceramic/poly media. |
| AM Solutions: Wet Grinding + Polishing | 0.8 - 1.5 | 32 -“ 60 | Comparable to semi-finish machining. |
| AM Solutions: Multi-step Process (e.g., Dry + Wet + Paste) | 0.2 - 0.5 | 8 - 20 | Achieves near-honing levels; aerospace-ready. |
| AM Solutions: DLyte (dry electropolishing) | 0.05 - 0.1 | 2 - 4 | Mirror-like finish; best for internal channels & fine geometries. |