Mineral-based polyurethane (PU) coating vs **acrylic coating**

A **mineral-based polyurethane (PU) coating** and an **acrylic coating** can both protect building surfaces, but they have different strengths. In general, a well-formulated mineral-based PU coating offers superior durability and performance, while acrylic coatings are usually lower cost and easier to apply.

Property	Mineral-Based PU Coating	Acrylic Coating
UV resistance	Excellent (especially aliphatic PU)	Good to very good
Lifespan	15–30+ years (depending on formulation and exposure)	5–15 years
Abrasion resistance	Excellent	Fair to good
Flexibility	Excellent	Good
Waterproofing	Excellent	Moderate to good
Chemical resistance	Excellent	Limited
Dirt pick-up	Low	Moderate to high
Thermal stability	Excellent	Moderate
Vapour permeability	Can be engineered	Generally good
Adhesion	Excellent to many substrates	Good on porous substrates
Production Cost	Higher	Lower

1. Much longer service life

A mineral-based PU coating forms a denser, tougher film.

Advantages include:

- resists chalking
- resists erosion
- maintains film thickness
- less frequent repainting
- lower life-cycle cost

Many exterior acrylic paints gradually become porous after years of UV exposure, while aliphatic polyurethane coatings retain their integrity much longer and stronger.

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2. Better waterproofing

PU coatings have much lower water permeability.

Benefits include:

- prevents rain penetration
- reduces moisture ingress
- protects reinforcement steel
- reduces freeze-thaw damage
- limits salt penetration in coastal areas

Many mineral-filled PU systems also bridge small cracks.

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3. Superior mechanical toughness

Polyurethane is far more resistant to:

- scratching
- impact
- abrasion
- wind-blown sand
- hail

This is why polyurethane is commonly used on industrial floors, aircraft, marine equipment, and heavy infrastructure.

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4. Better adhesion

Acrylic coatings primarily rely on mechanical adhesion.

Mineral-modified PU coatings often develop:

- stronger chemical bonding
- higher cohesive strength
- better adhesion to:
    - concrete
    - fibre cement
    - masonry
    - steel
    - aluminum

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5. Better resistance to chemicals

PU coatings resist:

- acid rain
- cleaning chemicals
- oils
- fuels
- solvents
- bird droppings

Acrylic coatings can soften or degrade under prolonged chemical exposure.

6. Higher thermal stability

Mineral fillers typically have low coefficients of thermal expansion.

This means the coating:

- expands less
- contracts less
- experiences lower internal stress
- is less prone to cracking

7. Improved fire behaviour

Mineral fillers can:

- reduce smoke generation
- improve fire resistance
- slow flame spread
- lower combustible content

This depends on the specific formulation and should be demonstrated through appropriate fire testing.

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8. Better resistance to dirt

PU surfaces are generally:

- smoother
- harder
- less porous

As a result, they:

- collect less dirt
- resist staining
- remain cleaner
- maintain appearance longer
- very low to no VOC

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9. Better colour retention

Aliphatic PU resins are among the best-performing polymers for:

- gloss retention
- colour stability
- resistance to yellowing

Acrylic paints can gradually lose colour intensity over long-term UV exposure, particularly in the very harsh Australian conditions.

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10. Better crack bridging

PU coatings elongate more before failure.

Typical elongation:

- Acrylic paint: **50–150%**
- Flexible PU coating: **200–600%** (or more for elastomeric systems)

This allows PU coatings to tolerate movement in the substrate more effectively.

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What does the mineral component contribute?

A mineral-based PU system may incorporate fillers such as:

- silica
- ceramic microspheres
- wollastonite
- mica
- kaolin
- alumina trihydrate
- calcium carbonate
- hollow glass microspheres

These minerals can:

- increase hardness
- improve abrasion resistance
- enhance dimensional stability
- reduce thermal conductivity (depending on filler type)
- improve UV durability
- improve fire performance
- reduce resin demand and shrinkage

Specialty fillers such as hollow ceramic or glass microspheres can also reduce density and slightly improve thermal insulation, though the effect depends on loading and overall formulation.

Where acrylic still has advantages

Acrylic coatings remain a strong choice in many applications because they are:

- less expensive at the RRP
- easy to manufacture
- simple to apply
- available in a wide range of colours
- fast drying
- generally easier to touch up or repaint
- often have good vapour permeability, allowing moisture in masonry to escape

For standard residential repainting where the service life expectation is around 4–10 years, acrylics often provide a good balance of cost and performance.

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Overall comparison

For high-performance building envelopes, infrastructure, and demanding environments, a mineral-based **aliphatic PU coating** generally offers:

- **2–3× longer service life**
- superior waterproofing
- greater abrasion and impact resistance
- improved chemical resistance
- better UV and colour stability
- reduced maintenance
- lower whole-of-life costs despite a higher initial investment
- coating for interior and exterior for the same coating mix

If your mineral-based PU coating is also designed as a **thermal coating, as in TDC (30% + less energy flow)**, the choice of mineral fillers and the coating's microstructure become especially important. In that case, the performance differences can extend beyond durability to include reduced heat/cold transfer, lower surface temperatures, and improvements in building energy efficiency—provided by NATA laboratory and field testing (UNI SA).

For lower-cost decorative applications with low to moderate performance requirements, **acrylic** coatings remain a practical option.

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