

ANS PPA-4 / ARI — Adaptive Reinforcement Ink: the Portfolio, Printed

Print the armor in — never paint it on.

A 3D-printable conductive ink that builds broadband EMI/EMP shielding AND structural reinforcement into a printed part in a single pass — no post-fabrication coating, ever — with the protected frequency band set by the recipe and the printed pattern, and self-healing embodiments in which the absorbed attack's own heat becomes the repair trigger.

The manufacturing key to the ANS portfolio: **the same deposited network is the shield and the strength — tuned in the slicer, healed by the hit.**

U.S. PROVISIONAL FILED — APPLICATION #64/087,652 · 10 JUN 2026

ENABLING FORMULATION & PROCESS DETAIL AVAILABLE UNDER MUTUAL NDA

Filed IP fact — as disclosed and claimed in the filed provisional

Engineered design target — anchored to published, peer-reviewed results for the constituent technologies; integrated-system test is the next step

① SINGLE PASS, DUAL FUNCTION

- ▶ **One deposited filler network provides BOTH electromagnetic shielding and mechanical reinforcement** — claimed with an affirmative "no post-fabrication coating step" limitation: the method itself forbids the second step everyone else needs.

The print IS the shield — no spray booth, no added mass, no coating to crack, peel, or leak at the seams.

- ▶ **Shielding targets: ≥ 20 dB X-band representative marker at ≥ 1 mm; ≥ 40 dB X-band at 2–5 mm (carbon lane) or 1–2 mm (metal / MXene lane).**

99–99.99% of incident X-band energy stopped at millimeter wall thicknesses — targets anchored to published printed-composite results.

② FREQUENCY-ADAPTIVE BY PRINT

- ▶ **Tuned by formulation:** filler identity and loading set the conductivity, sheet resistance, and shielding band of the deposited material — three claimed loading lanes from minimal-mass to maximal-conductivity.

Pick the recipe, pick the band — same printer, different ink lane, different protection profile.

- ▶ **Tuned by pattern:** a printed frequency-selective deposition pattern whose unit-cell period and element geometry set the resonant / absorptive frequency of the part.

Tune the shield in the slicer — the printed pattern itself selects which threat band the part attacks hardest.

③ SELF-HEALING & STRENGTH CLAIMS

- ▶ **Self-healing embodiments (claimed):** a dynamic-bond matrix restores electrical conductivity after thermal or mechanical damage — and the absorbed threat's own heat can serve as the thermal repair trigger.

Hostile energy redirected into recovery — the attack supplies the heat that heals the shield.

- ▶ **Reinforcement claims:** elastic-modulus increase of $\geq 50\%$ (floor) with a claimed $\geq 150\%$ tier — anchored to published $+177\%$ modulus in printed CNT/PLA at 15 wt%.

The same network that shields also stiffens the part — up to 2.5× the bare polymer's modulus in the published anchor system.

- ▶ **Prints the whole portfolio:** DIW paste/gel and FDM filament forms; claimed embodiments deposit the PPA-1 shielding composite, PPA-2 multi-domain material, and PPA-3-consistent graded reinforcement as constituents (constituent-only — no double-claim).

One ink and method that can lay down every material in the ANS family — without re-claiming them.

④ STATUS & IP

- ▶ **IP — U.S. provisional FILED:** Application #64/087,652, filed 10 Jun 2026 (Conf. #7756) — **completing the four-application ANS portfolio** (#64/020,126 · #64/081,373 · #64/086,584 · #64/087,652).

Priority date locked — the full portfolio is now on file at USPTO.

- ▶ **Maturity (honest):** constituent technologies range from lab-validated to commercially fielded (component TRL ~4–9; conductive feedstocks and FSS are established art); only the integration is new (TRL 2–3). **Low-risk ingredients, high-value recipe.**

Every ingredient already works in the published record — the invention is the recipe and the single-pass method.

- ▶ **Sovereign & defensive:** wholly inventor-owned, unencumbered; D1–D4 defensive-only locks recited in all four independent claims.

Free and clear to license — and purely defensive by claim construction, not just by policy.

WHAT PPA-4 ADDS — The manufacturing key to the whole portfolio. Everyone else makes a part and then coats it; ARI prints the shield and the strength into the part in one pass, tunes the protected band with the recipe and the printed pattern, and in self-healing embodiments turns the absorbed attack's heat into the repair signal. PPA-1 is the smart material, PPA-2 hardens it, PPA-3 is the armored frame — **ARI is the ink that prints them into hardware. All four applications are now on file at USPTO.**

Enabling formulation & process detail available under mutual NDA. This page states *what* the ink and method are engineered to do, with claim-level features. It deliberately does *not* disclose formulations, loading ratios, rheology windows, or print parameters — the proprietary *how*.

Non-proprietary technical overview — no NDA required to read this page. Ink and method scoped as passive / defensive (shielding and reinforcement only — no offensive EM function; D1–D4 negative limitations in every independent claim). Figures labeled as targets are engineered design targets anchored to published, peer-reviewed results for the constituent technologies; integrated-system performance is not yet bench-tested; validation is the objective.

RACHAEL V HAGER DBA ANS COMPOSITE · CAGE 1ZST9 · UEI RK38AE8R1EP6 · SAM-active · micro-entity / woman-owned · contact@anscomposite.com