Flammability & Combustibility Assessment EID600 (Ultra-Fine Elemental Iron Powder)

1) Executive summary

- At rest (pile, "rested position"): Your observation that EID600 does not ignite when exposed directly to a propane flame is consistent with many "Flammability (solids) – EU A.10" outcomes for certain iron powders, which often do not propagate burning as a pile. Some suppliers' SDSs likewise report "not flammable (solid)" for iron powder under that test. (https://echa.europa.eu/substance-information/-/substanceinfo/100.028.237)

- As a dispersed dust cloud: Your observation that airborne particles ignite/burn aligns with OSHA/NFPA guidance: metals such as iron can be explosible in dust form, even if they don't burn readily in bulk. Iron powder dust is typically ST-1 (Kst > 0–200 bar·m/s), i.e., combustible dust with explosion potential. (https://www.osha.gov/combustible-dust)

- Important nuance: Some specific iron powders—especially carbonyl iron (CIP) or very fine, uncoated grades—are classified as flammable solids and/or self-heating; reactivity varies by particle size, surface oxide, and manufacturing route, so material-specific testing is essential. (https://echa.europa.eu/substance-information/-/substanceinfo/100.028.237)

2) Why a pile behaves differently from a dust cloud

- Pile at rest: Heat is conducted away; the surface oxide on iron inhibits rapid oxidation; EU A.10 looks for sustained propagation along a powder train and many iron powders fail to propagate. (https://echa.europa.eu/substance-information/-/substanceinfo/100.028.237)

- Dust cloud: When dispersed, surface area and oxygen mixing rise dramatically, enabling rapid oxidation/deflagration if concentration is within explosible limits and an ignition source is present. OSHA explicitly notes iron among metals that can be explosible as dust. (https://www.osha.gov/combustible-dust)

3) Key parameters for EID600 (what to measure)

- Explosibility screening/severity: ASTM E1226 (20-L sphere) determines explosible? (Go/No-Go) and, if yes, Kst and Pmax (severity). Many iron powders show low Kst but still >0 (ST-1), meaning a true explosion hazard remains. (https://www.astm.org/e1226-19.html)

- Ignition sensitivity: ASTM E2019 for Minimum Ignition Energy (MIE); metal dust MIE can be low, particularly for very fine particles—making electrostatic discharges credible ignition sources. (https://www.astm.org/e2019-03r13.html)

- Concentration limits: MEC (minimum explosible concentration) for dusts commonly lies ~20–250 g/m^3. (https://www.osha.gov/otm/section-ii/chapter-3#combustible_dusts)

- Classification context: ST classes: ST-1: 0 < Kst ≤ 200, ST-2: 200–300, ST-3: ≥300. Most iron powders fall in ST-1. (https://www.osha.gov/combustible-dust)

4) What standards say (and why sources differ)

- OSHA/NFPA: OSHA's combustible-dust page states that even metals that don't burn in larger pieces (aluminum, iron) can be explosible in dust form; NFPA 484 is the governing standard for combustible metals. (https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=484)

- EU A.10 flammability (solids): Some iron powders do not ignite/propagate in the A.10 strip test (thus "not flammable (solid)"), which matches your pile test. (https://echa.europa.eu/substance-information/-/substanceinfo/100.028.237)

- But: Certain fine or carbonyl irons are classified Flammable solid, Cat. 1 and/or Self-heating, Cat. 1 under GHS/CLP, demonstrating the grade-specific nature of iron powder hazards. (https://echa.europa.eu/substance-information/-/substanceinfo/100.028.237)

- SDS examples: Some suppliers list "not flammable" (solid) while simultaneously warning ST-1 combustible dust. This isn't contradictory—solid flammability and dust explosibility are different tests/hazards. (https://www.kremer-pigmente.com/elements/resources/products/files/17300_SDS_en.pdf)

5) Practical interpretation for EID600

- Your findings (no ignition as a pile; ignition when dispersed) are expected for many iron powders and consistent with combustible-dust behavior. Treat EID600 as combustible dust pending formal testing. (https://www.osha.gov/combustible-dust)

- Expectations: EID600 is likely ST-1 (non-zero Kst but generally "low" vs. more reactive metals), yet still capable of damaging deflagrations if accumulated/airborne and ignited. (https://www.kremer-pigmente.com/elements/resources/products/files/17300_SDS_en.pdf)

6) Recommended next steps (for your SDS and operations)

1) Commission dust testing on the actual EID600 lot(s): ASTM E1226 (Go/No-Go; Kst, Pmax), ASTM E2019 (MIE), ASTM E1515 (MEC), and ASTM E1491/E2021 (MIT of dust cloud/layer).

2) SDS language (interim, until lab data): "May form combustible dust concentrations in air (OSHA)"; reference NFPA 484 controls for metal powder handling.

3) Engineering & work practice controls: Local exhaust with spark-safe design; bonding/grounding to manage ESD; enclosed transfer where possible; certified HEPA vacuums; avoid dry sweeping. (https://www.osha.gov/otm/section-ii/chapter-3#combustible_dusts)

4) Fire response: For metal powder fires, use Class D media; do not apply water/CO_2 directly on burning iron powder. (https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=484)

5) Storage: Keep sealed, dry, away from oxidizers/ignition sources; consider inert headspace for large inventories; follow NFPA 484. (https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=484)

7) Proposed statement for your SDS (draft)

Flammability/Combustibility: EID600 (ultra-fine iron powder) may not ignite or propagate as a compact pile under EU A.10 flammability-of-solids criteria; however, when dispersed as a dust cloud it is combustible/explosible. Treat as combustible metal dust (ST-1 expected) and control ignition sources, dispersion, and dust accumulation per NFPA 484 and OSHA combustible-dust guidance. Perform material-specific testing (ASTM E1226, E2019, E1515) to establish Kst, Pmax, MIE, MEC and finalize classification.

References

- OSHA Combustible Dust Overview – https://www.osha.gov/combustible-dust
- OSHA OTM — Combustible Dusts – https://www.osha.gov/otm/section-ii/chapter-3#combustible_dusts
- NFPA 484 Standard for Combustible Metals – https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=484
- ASTM E1226 (20-L sphere) – https://www.astm.org/e1226-19.html
- ASTM E2019 (MIE) – https://www.astm.org/e2019-03r13.html
- Kremer Pigments SDS – https://www.kremer-pigmente.com/elements/resources/products/files/17300_SDS_en.pdf
- ECHA Iron Dossier – https://echa.europa.eu/substance-information/-/substanceinfo/100.028.237