

# TECHBRIEF

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## Biodegradable Alloys for Implantable Medical Devices

### Opportunity

Temporary implants must combine the strength of structural metals with a degradation profile that closely follows tissue healing, yet many iron-based systems corrode too slowly or break down unevenly. Researchers at the U.S. Department of Energy's National Energy Technology Laboratory (NETL), in collaboration with BIO DG Inc., engineered a biodegradable alloy in which a halogen-bearing phase is incorporated directly into the iron matrix to promote steady, uniform corrosion. The modified electrochemical environment encourages controlled surface dissolution rather than pitting or particulate formation, while the underlying alloy retains the mechanical performance needed for early-stage load support. By adjusting the concentration and distribution of the reactive phase, degradation rates can be matched to clinical timelines for orthopedic, dental or soft-tissue devices. This technology is available for licensing and/or further collaborative research from NETL in partnership with BIO DG.

### Problems Addressed

- Stainless steel implants often require removal once healing occurs and are not biodegradable.
- Existing biodegradable polymers lack sufficient mechanical strength for load-bearing, deformable, or high-stress implant applications.
- Conventional steels degrade unpredictably, forming fissures and particulates that can migrate and cause serious injury.
- Many metal alloys contain toxic elements that pose risks when released into the body.

### Potential Commercial Applications

- Temporary or semi-permanent orthopedic fixation devices such as screws, anchors, plates, supports, and rods.
- Internal tissue fastening devices including surgical staples and fasteners.
- Biodegradable dental implants and vascular stents.

### Competitive Advantages

- Iron-based alloys incorporating a halogen reactive component provide controlled, predictable biodegradation without particulation.
- Enhanced degradation rates compared to similar alloys lacking the iron reactive component.
- High mechanical strength suitable for load-bearing and deformation during implantation.
- Degradation behavior tunable by adjusting the concentration or distribution of the iron reactive component.

### Publications

H. Radisch, P. Jablonski. Implantable medical devices comprising biodegradable alloys with enhanced degradation rates. (2020). United States Patent and Trademark Office. U.S. Patent No. 10,765,775.

### Intellectual Property Status

A U.S. patent (US10765775) was issued on September 8, 2020, and expires on March 14, 2034.

### Licensing / Collaboration

Partnerships@netl.doe.gov

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