# Self-organization by irradiation and plastic deformation

## Opportunity

- Alloys subjected to forced mixing and disordering by irradiation and plastic deformation can self-organize at scale ≈ 5 to 100 nm scale. Self-organization results from competition between thermal and forced dynamics.
- Tunable length scales by controlling forcing rates, temperature, and chemistry.
- Potential applications: high resistance to irradiation, to wear, high strength and ductility.

## Approach

- Develop kinetic modeling of concentrated multicomponent alloys; integrate with stress fields and defect motion.
- Design critical experiments to validate models.
- Develop fabrication methods: top-down (irradiation, ECAE, HPT, ARB, FSW,…) v. bottom-up (ball milling, electro-deposition, …), lab scale v. industrial scale

## Meso Challenge

Self-organization and improved properties result from collective response of defects (point-, dislocations, GBs) at scales dictated by diffusion and stress fields, and mean free path of defects.

## Impact

- Research will allow for rational and accelerated design of meso- and nano-structured alloys, e.g., nano-ODS steels for nuclear applications, wear-resistant coatings, high strength-to-weight ratio structural alloys.

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