



**Research in one sentence**

**Cost-effective ultrahigh strength high entropy alloys (HEAs) can make light-weight structures with significant materials and energy savings.**

**What is your uniqueness in your research?**

We primarily work on developing novel ultrahigh-strength materials for advanced structural applications. Ultrahigh-strength materials can lower the cross-section of the components, enabling the development of lighter structures, reduced volume usage of materials, lower energy composition, and strengthening the sustainable manufacturing ecosystem.

In particular, we focus on developing high entropy alloys (HEAs) with novel mechanical properties. In contrast to conventional alloys based on one principal element, HEAs are developed as multicomponent alloys (usually greater than five components) with equiatomic or near-equiatomic concentrations. The high configurational entropy may stabilize these alloys into solid solution phases. This novel alloy design strategy enables opening up the massive composition space for developing novel alloys with superior mechanical properties.

We further try to enhance the mechanical properties of the HEAs using microstructural tailoring by thermo-mechanical processing treatments. We have developed novel HEAs such as  $\text{AlCoCrFeNi}_{2.1}$  with novel heterogeneous microstructure and unprecedented mechanical properties.

Unfortunately, the presence of costly alloying elements such as cobalt hinders the widespread adaption of these HEAs for engineering applications. Therefore, we try to overcome these challenges by designing cost-effective HEA compositions while retaining their superior mechanical properties.

Interview with PI of JICA Research Grant under FRIENDSHIP2.0 Project

### **Background of joint research with Japanese Co-PI**

My Co-PI is Prof. Nobuhiro Tsuji from Kyoto University, and our topic of joint research is the Development of novel cost-effective high entropy alloys with superior mechanical properties

I found Professor Tsuji through his work on ultrafine-grained materials. Particularly the novel processing technique, i.e., Accumulative Roll Bonding (ARB), that his group developed, was noticed by me and encouraged me to collaborate with him.

### **What are the tips to have collaborated with Co-PI for so long?**

I have collaborated with him for almost 15 years now. Our collaboration started with my stay at Osaka University as a JSPS fellow in his group from 2007 to 09. We have continued the collaboration very successfully even after my return to India. Our mutual understanding, appreciation, and professionalism are key to the success of our collaboration.

### **What are the benefits from collaboration with Japanese Co-PI?**

Through collaboration, we share knowledge, expertise, and resources which are enriching for both groups.

### **Prospects regarding India-Japan collaboration**

I will continue to collaborate actively with the group of Prof. Tsuji. Since I am in Japan presently as a JSPS invitation fellow, I will accept opportunities to collaborate with other research groups., too.

### **Do you recommend JICA Research Grant under FRIENDSHIP 2.0 to the other faculty members?**

Yes, I strongly do. Both faculty members and students should be exposed to a new environment. This grant allows us to establish/continue collaborative activities with Japanese professors. If we can make good friends, that must help our research successfully.