GIF Pitch コンテスト 2021　優勝者からのアドバイス

コンテスト概要：

GIF Pitch コンテストは、**第 4 世代原子力システムに関連する研究開発**（炉開発のみならず関連技術開発を含む）に従事する若手研究者を対象とする、**英語論文ショートスピーチコンテスト**（Pitch Your Generation IV Research Competition）。ここで、第 4 世代原子力システムは、通常発電用途で用いられる次世代型の原子炉を広く指している（参照：https://gif.jaea.go.jp/about/index.html）。本コンテスト自体は、GIF が主催機関であり、**2021 年度から実施**している。応募は、第 4 世代原子力システム開発国を中心になされ、2021 年度は、日本を含む世界 16 か国から 51 件の応募があり、そのうち 21 件が 2 次選考へと進んだ。

コンテストの各ステップ

- 1 次選考：応募対象研究内容の Executive summary(上限 750 ワード。図は 250 ワード換算)を作成し、オンラインフォームで提出。(2021 年 2 月末締切り)。GIF 参加国から選出された専門家パネルの審査により最大 25 名程度を選抜。採点基準は、１）第 4 世代原子力システムとの関係性、２）オリジナリティ、３）意義・重要性であり、各 5 点。
- 2 次選考：3 分間のプレゼン動画を作成し、提出。(2021 年 3 月末締切り)。プレゼン動画はオンライン上に公開され、専門家パネルの投票と一般投票により優秀者を選定。 専門家パネルの採点基準は、１）クリエイティビティ（いかに聴衆の注意をひきつけるか)、２）有効性（非専門分野の技術者にとって、どの程度理解しやすいか)、３）技術的品質（技術成果がどれだけ表現できているか）であり、各 5 点。
- 表彰（1 位：1 名。2 位：2 名。表彰品：GIF ウェビナー講師としての招待。GIF 会合への招待。1 次選考通過者はプレゼン動画を公開。5 月上旬見込み）

2021 年度内容/結果：

https://gif.jaea.go.jp/event/2021_Pitch_Competition/report.html

対象者：

博士課程在籍者、2019 年 1 月以降に博士号を取得した若手研究者（含ポスドク）

添付資料

2021 年のコンテスト優勝者は、CEA の Dr. VILLARET Flore。
なお、コンテスト後に CEA から EDF に入社。
彼女から、提出したサマリーとアドバイスをいただいているので、以下に添付する。

なお、コンテスト賞品として、招待された GIF ウェビナーの講師権限として、2021 年 12 月 15 日に、「積層造形技術を用いたオーステナイト鋼－マルテンサイト鋼の傾斜接続」のタイトルで、ウェビナーを実施している。

GIF ウェビナー
積層造形技術を用いたオーステナイト鋼－マルテンサイト鋼の傾斜接続」
Development of an Austenitic/Martensitic Gradient Steel by Additive Manufacturing
Presenter: Dr. Flore Villaret, EDF, France

https://gif.jaea.go.jp/webinar/index.html#webinar060

Pitch your Gen IV Research Competition 2021
Executive Summary Submittal Form

Development of an austenitic/martensitic gradient steel by additive manufacturing

AUTHOR'S NAME AND AFFILIATION
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KEYWORDS: Additive manufacturing, 316L austenitic stainless steel, Fe-9Cr-1Mo martensitic steel, gradient material, powder metallurgy

EXECUTIVE SUMMARY CONTENT

This PhD work concerns the problem of bimetallic austenitic/martensitic steel connections. This research action focuses on a 316L austenitic steel (X2 CrNiMo 18-12-02) / Fe-9Cr-1Mo (X10 CrMo 9-1) martensitic steel connection. Such connections are typically found in sodium fast reactors assemblies between wrapper tubes and assembly spikes. The objective is to understand the metallurgical problems related to the assembly of these two steels and to evaluate the possibilities of using powder metallurgy and additive manufacturing to produce austenitic/martensitic steel transitions.
A weld obtained by electron beam is used as a reference for this study, which focuses on the interest of powder metallurgy to achieve a transition between two steels. Materials with a chemical composition gradient have been consolidated by HIP (Hot Isostatic Pressing) and SPS (Spark Plasma Sintering) and show very good mechanical properties and an excellent junction between the two steels.
By additive manufacturing (Laser Beam Direct Energy Deposition (DED-LB) or Laser Beam Powder Bed Fusion (PBF-LB)), we also obtain very good bonds between the two steels, but the microstructures are much more complex (see figure (a)).
Curiously, we observe that the higher the cooling rate, the higher the ferrite fraction in the martensitic steel. Different calculations based on the nucleation and growth of the austenitic phase have made possible to propose a coherent scenario to explain the phase fractions present in the materials. These observations and calculations gives a new insight on the Fe-9Cr-1Mo CCT diagram, yet well know, to include very fast cooling rates observed in additive manufacturing and explain the observed microstructures (see figure (b))
The transition zone between the two steels shows strong variations in hardness. These variations are explained by changes in chemical composition, leading to modifications in phase change temperatures, and the particular thermal cycles seen during building.
From a technological point of view, materials obtained by additive manufacturing have tensile performances very similar to those obtained by electron beam welding. It is shown that additive manufacturing also makes possible to control the composition gradient between a martensitic and an austenitic steel.
Beyond the replacement of already existing parts, the possibilities opened by the additive manufacturing of gradient materials are very varied. It also constitutes a new tool at the disposal of design offices to imagine new designs and applications. This study demonstrates the potential presented by these gradient materials for future innovations.

Pitch your Gen IV Research Competition 2021
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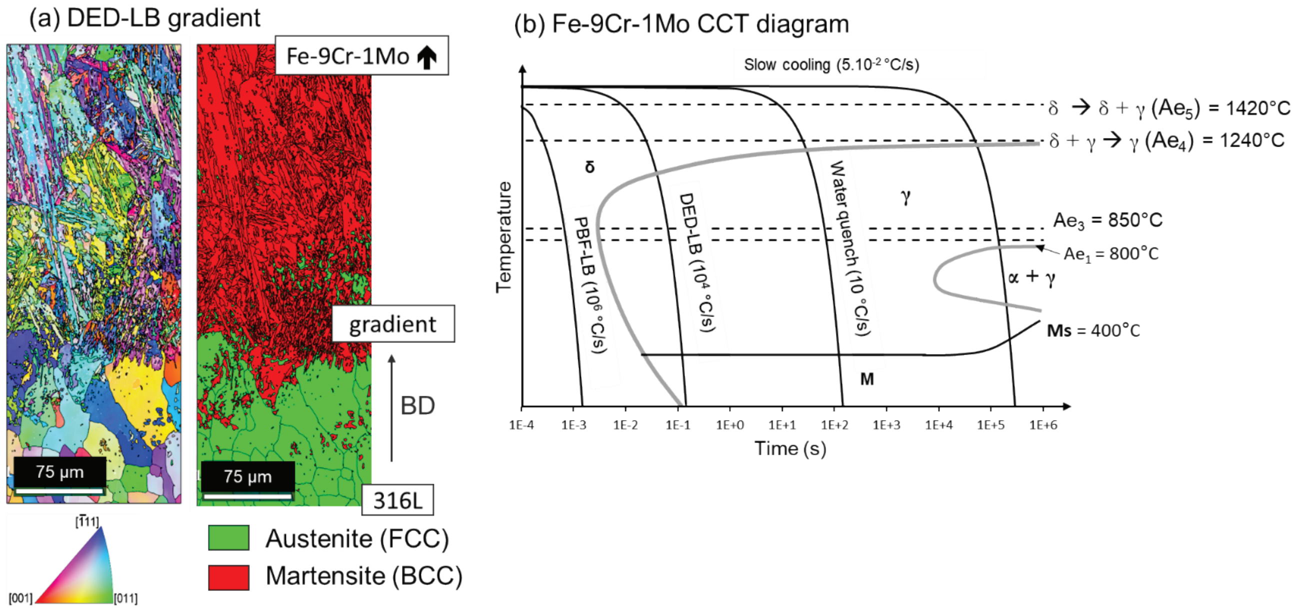

Figure: (a) EBSD map (inverse pole figure and phase map) of the microstructures at the place of the chemical gradient. (b) Schematic CCT diagram of the Fe-9Cr-1Mo to report phases transformations in rapid cooling from δ phase.

DATE OF Ph.D. DEFENSE
23 November 2020

SUPERVISOR'S/MENTOR'S INFORMATION
***, CEA, ***
***, INSA Lyon, ***
***, CEA, ***
***, INSA Lyon, ***

PUBLICATION(S)

F. Villaret, X. Boulnat, P. Aubry, J. Zollinger, D. Fabrègue, Y. de Carlan « Study of δ →γ phase transformation kinetics in martensitic steels: application to powder metallurgy and additive manufacturing » , *submitted in Materialia, first look avaible at* http://ssrn.com/abstract=3782879

F. Villaret, X. Boulnat, P. Aubry, Y. Yano, S. Ohtsuka, D. Fabrègue, Y. de Carlan « Laser Beam Direct Energy Deposition of graded austenitic-to-martensitic steel junctions compared to dissimilar Electron Beam welding » , *submitted in Journal of material processing and technology*

Advise from competition winner (Dr. VILLARET Flore)

For the summary as for the video I was forced to make a selection in my work and only talk about the most important things. Also, I tried to explain it with simple concepts, as the GIF jury is composed of many different scientific disciplines.
It is not an easy exercise to find the good balance between the technical parts, showing the quality of the scientific work, and the more popularized parts, needed for everyone's understanding. Using daily life example to explain technical things could be a good tip.
For the video, I spent some time looking at the scientific popularization video on youtube, and especially looking how they are made.
I noted these few points, that I tried to apply in my video after :

* The sequences are often very short : each 1 or 2 phrases (20-30 seconds) the shot changes (either you have a new scene, a new drawing, a zoom or something which keep the attention)
* Be very enthusiastic
* Let some small time without any text or voice so the public can breathe a little
* A dynamic music could be a good way of catching the attention at the beginning or bringing back the attention during the video

First I took some time to think about the message that I would like to pass through the video (in my case, the possibility to use additively manufactured parts in nuclear reactors), and write the text in this way (aimed to last less than 3 min, so there is time without text). I think this was the harder part for me.
Then I imagine which images or slides or action I can put with the text. I had also few peoples to read the scenario and give me their opinion, it was very helpful.
To make the video I used my phone (parts outside) or my computer with zoom with my slides or an image in background, then I used a video editing software (like windows movie maker) to stitch all the small shots with the music (picked in the youtube free music catalogue) and the voice. Except for the parts outside I used a prompter (my phone or a paper) to be able to easily say the text I had written.
In the end… if you get bored looking at your how video, then other will also !

I hope it could help your young Japanese scientists !