

EPRI Workshop on “Dissimilar Welds in High Temperature Applications” held in Collaboration with ASME PVP, 2017

Where. Hilton Waikoloa, Hawaii, USA

When. Thursday and Friday July 20 - 21, 2017

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Further information regarding the PVP conference and the location is available from:
<https://www.asme.org/events/pvp/venue-travel>.

This workshop will be **presentation only** (no formal technical papers). Abstracts of about 250 words outlining presentation content should be sent by January 31st 2017 to Elizabeth Benton at ebenton@epri.com.

Workshop Background

The need to balance cost and performance means that in most high temperature plants there will be the need to transition from one alloy to another within the pressure boundary. There is a very large range of choices available to designers when considering details of these joints. Because different approaches are used the in-service life of DMWs has been very variable. This variability creates uncertainty and this is problematic for many reasons. Firstly, since post-construction life management activities are typically based on a reasonable expectation of in-service performance (i.e. when a DMW will fail). Secondly, particularly for DMWs in piping and vessels a key performance issue is how components fail. Issues of leak or break are frequently assessed using a component damage tolerance approach.

The range of applications and materials used in DMWs has recently increased because of the widespread use of advanced steels and other high temperature alloys. The greater range of material combinations has further complicated assessment on in-service performance. The increased variability in performance because behavior is that not only sensitive to details of design, fabrication, and operation but also, in the case of tempered martensitic steels, there is a metallurgical risk factor to consider. Failures have been observed in DMWs between 9Cr CSEF steels and austenitic stainless steels that have been welded using a nickel-base filler metal. Examples of recent failures this type of DMW are listed below:

1. Catastrophic failures in stainless steel flow element nozzles and stainless steel thermowells welded into Grade 91 steel piping systems in heat recovery steam generator (HRSG) systems;
2. Repeat failures in the form of leaks in thick-section Grade 91 steel to stainless steel girth welds at terminal points and material thickness transitions in main steam piping systems;
3. Failures in stainless steel attachment and slip spacer welds to 9Cr tubing (failures numbering in the tens of thousands);
4. Failures in tube to tube butt welds in superheater pendants and HRSG harps;
5. Failures of stainless steel warming lines connected to Grade 91 valve bodies.

Fracture of a DMW weld in a superheater tube

Fracture of a DMW weld at a thermowell attachment



Avoiding designs which are linked to a high risk of fast fracture is vital from a safety perspective. Preventing catastrophic fracture also minimizes the potential for collateral damage and reduces the extent and complexity of repair scenarios. Current EPRI strategy is to achieve well defined DMW performance through the introduction of a methodical set of engineering recommendations linked to both design and fabrication.

The present Workshop offers the opportunity to review current approaches, issues and solutions for the use of '**well engineered**' dissimilar Joints. Sessions will review design considerations and fabrication techniques which are discussing currently considered best practice for DMWs. State of knowledge general application guidelines which can increase weld performance will be presented. Improved performance will consider lifetime (i.e., **when** the DMW will fail) and damage tolerance (i.e., **how** the DMW will fail). It is apparent that the present lack of consensus on these issues means that almost unlimited possibilities exist in DMW construction. Fitness for service issues for existing plant need to address DMW issues on a case-by-case basis. When remediation is required it is important sound engineering principles are applied to the requirements of each specific application.

Workshop Technical Areas

It is expected that this Workshop will be held over a day and a half from Thursday morning to mid-day on Friday. Technical sessions will involve the following topics:

- Invited Keynote presentations,
- Design and Fabrication,
- Dissimilar Welds in Ferritic Steels,
- Dissimilar Welds between Ferritic and Austenitic Steels,
- Joints between steels and Ni based alloys,
- Case Studies, and
- Lifting and Repair.

Each session will be led by a designated expert developer who will be responsible for the specific content. However, following the success of the 2016 workshop each session will aim for appropriate periods of discussion so that all delegates have the opportunity to raise questions / issues. For those offering formal presentations, Abstracts of about 250 words outlining presentation content should be sent by January 31st 2017 to Elizabeth Benton at ebenton@epri.com.

International Collaboration

The success of EPRI events is in part a consequence of the recognition that inclusive representation from all stakeholders in the Global Electricity Supply Chain is important. Typically delegates will attend from suppliers, designers, research organizations and service providers as well as end users / power generators. We invite interested individuals from all parts of the World to join us and to participate in the workshop.