# Validation of Finite Element Method Model for Rupture Disk Corrosion Test

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## 1. Introduction

Rupture Disk Corrosion Test (RDCT) has been developed recently for detecting stress corrosion cracking (SCC) initiation time of Ni and Stainless steel alloys in real time.[1]

To understand the SCC initiation, applied stress of the specimen is important variable. However, The RDCT method has disadvantage that applied stress of the specimen is not measured directly. In this study, as an alternative of direct measurement, Finite Element Method(FEM) is used to calculate the applied stress. In the calculation, influencing factors are considered for determining FEA model. To validate the FEM model, model of FEM is compared with the RDCT specimen in terms of deformation.

## 2. Methods and Results

In this study, alloy 600 material is used for the RDCT specimen that is compared with FEM result. ABAQUS$^{TM}$ is used for FEM simulation program.

### *2.1 Finite Element Method model*

The fixture and specimen drawing is shown in Figure. 1. Disk specimen, sealing gasket and upper fixture of the drawing are formed in 3d deformable extrusion solid In the FEM model. The model is shown in Figure. 2.

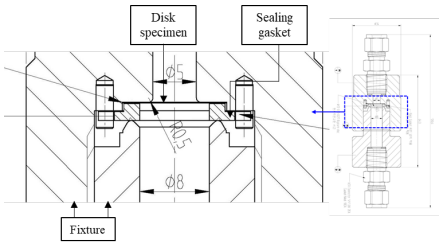


Fig. 1. Drawing of rupture disk corrosion test specimen, sealing gasket, fixture.

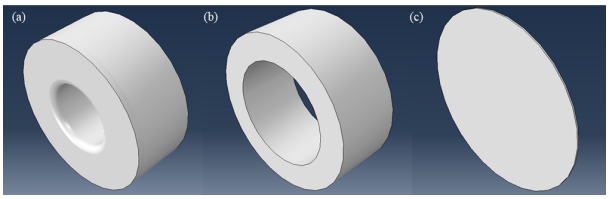


Fig. 2. Solid part image of (a) upper fixture, (b) sealing gasket, (c) disk specimen

### *2.2 influencing factors*

In this section, it is determined the influencing factors that are mesh size of part and frictional coefficient between the fixture and the specimen in simulation.

#### *2.2.1 mesh size*

For selecting appropriate mesh size, it is important to consider interaction surface in this model. Face to face between upper fixture and disk specimen is main interaction surface.(fig.1) there are 3 mesh size of the disk specimen for comparison, 0.4, 0.2, 0.1 as shown in Figure. 3.

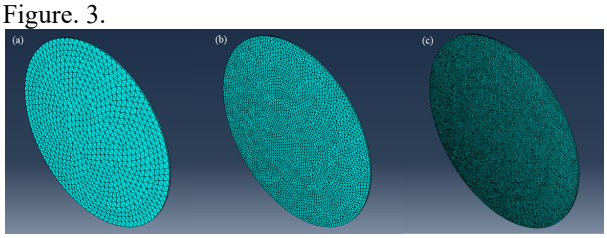


Fig. 3. Different mesh size of disk specimen (a) 0.4, (b)0.2, (c)0.1.

#### *2.2.2 friction coefficient*

On the face to face between upper fixture and disk specimen, frictional interaction occurs. Depending on frictional coefficient, analysis results of FEM are different in terms of deformation and the applied stress.[2] In this section, frictional coefficient is substituted in interaction part of ABAQUS$^{TM}$ program from 0.1 to 0.7 in 0.1 increments.

### *2.3 validation of Finite Element Method model*

To validate FEM model, the result of FEM analysis is compared with the RDCT specimen. The deformation of analysis result and RDCT specimen is dome shape as shown in Figure. 4.

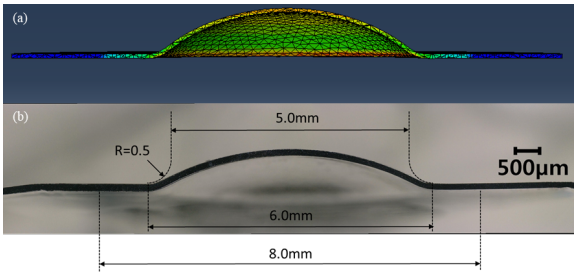


Fig. 4 comparison of deformation shape between (a)the analysis result and (b) the RDCT specimen.

In details, the height of dome in the analysis result is compared with the RDCT specimen cross-section.

## 3. Conclusions

In the FEA model, it is important to consider the influence factors that are frictional coefficient and mesh size. Then, by comparing the result of the FEM analysis with the RDCT specimen, it can be validated that FEM model properly imitate RDCT. By Using this model, it is expected that initiation time of RDCT specimen can be matched with applied stress calculated from the result of FEM analysis.

## REFERENCES

[1] ] G.Y. Jeon, S.W. Kim, D.J. Kim, C.Y. Jeong, Evaluation of Stress Corrosion Crack Initiation of Alloy 600 in Primary Water Using Rupture Disk Corrosion Test Method, submittes to Nuclear Engineering and Technology, 2021.
[2] Brown, V. Finite Element Modelling of the Small Punch Test for Structure Critical Design. Amsterdam University Press, 2020.