

The name of god

**Republic Of Iraq
Ministry Of Higher Education and Scientific
Research
University Technical of central
Mechanical Technical / production**



(Analysis Of Welded Joint Strength Using ANSYS)

**A graduation project is submitted to the Mechanical Department in partial
fulfillment of the requirements for the degree of Diploma of Science in
Mechanical Technical / production**

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قال الله تعالى

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ (1) خَلَقَ الْإِنْسَانَ مِنْ
عَلَقٍ (2) اقْرَأْ وَرَبُّكَ الْأَكْرَمُ (3) الَّذِي عَلَّمَ بِالْقَلَمِ
(4) عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ (5)

(صدق الله العلي العظيم)

(سورة العلق)

الإهداء

إلى من يسعد قلبي بلقيها
إلى روضة الحب التي تنبت أزكى الأزهار
أمي

إلى رمز الرجولة والتضحية
إلى من دفنني إلى العلم وبه ازداد افتخار
أبي

إلى من هم اقرب إلي من روعي
إلى من شاركني حزن الأم وبهم استمد عزتي واصراري
أخوتي

إلى من أنسني في دراستي وشاركني همومي تذكاراً وتقديراً
أصدقائي

إلى هذا الصرح العلمي الفتي والجبار
المعهد التقني

شكر وتقدير

الحمد لله رب العالمين، والصلاة والسلام على أشرف الخلق والمرسلين نبينا محمد صلى الله عليه وسلم وعلى آله الطيبين الطاهرين

أول الشكر وآخره أتقدم به إلى المنعم الباري عز وجل (الله) سبحانه وتعالى، الذي أحاطني برعايته الإلهية العظيمة، ويسّر لي كل عسير، وألهمني الصبر والقوة في شق طريقي نحو البحث العلمي

وأتوجه بخالص شكري وتقديري وعظيم امتناني إلى أستاذي الفاضل القدير الأستاذ / غسان شاكر الكناني ؛ لما أبداه من حسن رعاية ورعاية ورعاية علمية مخلصه، وما قدمه لي من توجيهات ونصائح سديدة وملاحظات قيّمة ومستمرة... فدعائي له بالخير والعافية

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Abstract :

The simulation of the welder was compared to the specimen of the tensile test with another specimen without welding, and both specimens Prepared as per ASTM for the Aluminum alloy (AA6061-T6). Where it was analysis Of welded joint strength by calculating the stresses and strain and deformation for both specimens in ANSYS workbench.

1. INTRODUCTION

Friction stir welding (FSW) is a recently emerged solid-state joining technology patented by The welding Institute (TWI) in 1991. Friction stir welding (FSW) is a solid state joining process that uses friction generated by a rotating cylindrical tool which produces heat and plasticize metal on either side of a joint, creating a solid functional weld. Friction- generated heat is more effective at reorganizing the microstructure of metals and metal alloys than other forms of fusion welding. This joining technique is energy efficient, environment friendly, and versatile. In particular, it can be used to join high-strength aerospace Aluminum alloys and other metallic alloys that are hard to weld by conventional fusion welding. FSW is considered to be the most significant development in metal

1.1 Definition of tensile test :

Tensile testing also known as tension testing is a fundamental materials science and engineering test

a sample is subjected To controlled tension until failure properties in which that are directly measured via a tensile test are ultimate tensile strength breaking strength , maximum elongation and reduction in area.

From these measurements the following properties can also be determine: Young's modulus, poisson's ratio , yield strength , and strain hardening characteristics .

Uniaxial tensile testing is the most commonly used obtaining the mechanical characteristics Of isotropic materials .

1.2 PARAMETERS FRICTION STIR WELDING

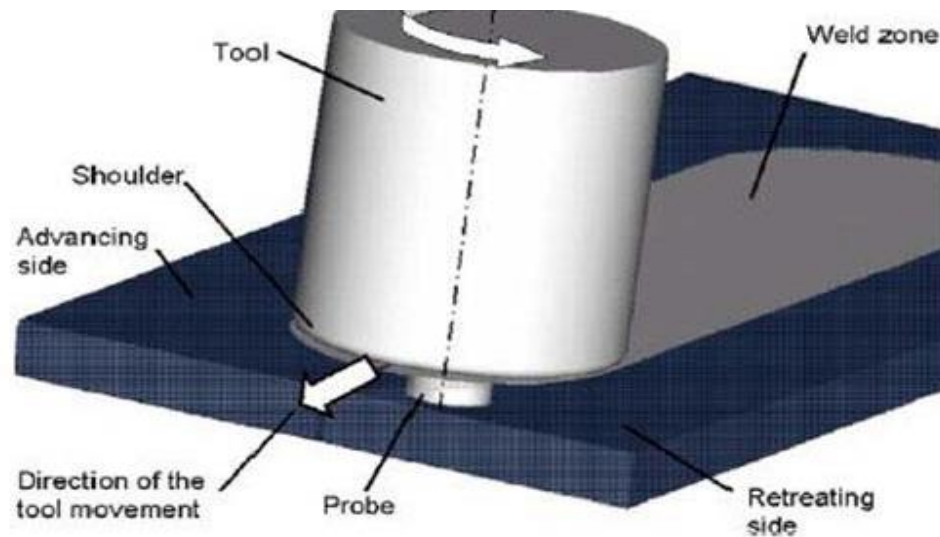


Fig.1: schematic illustration of FSW process

Table 1 : Mechanical properties of FSW Tool material

Material : H13 Tool Steel Prepared as per ASTM 387 Gr91

Properties	Value
Density	7700 kg/m ³
Modulus of Elasticity	210 Gpa
Hardness, Brinell	255
Ultimate tensile strength	1736 Mpa
Poisson's ratio	0.27-

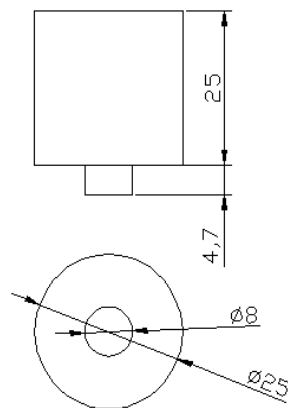


Fig.2 Schematic diagram of tool.

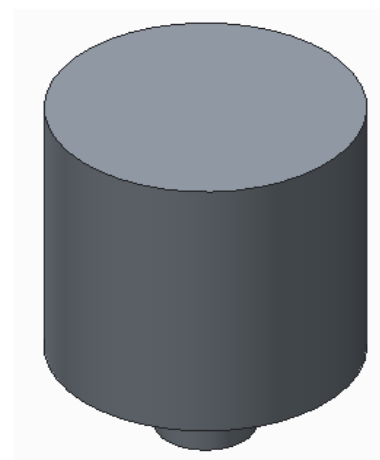


Fig.3 Model FSW Tool

1.3 SKETCH OF 2D MODEL

In fig.4 we see the Dimension of the 2D of the tensile test specimen

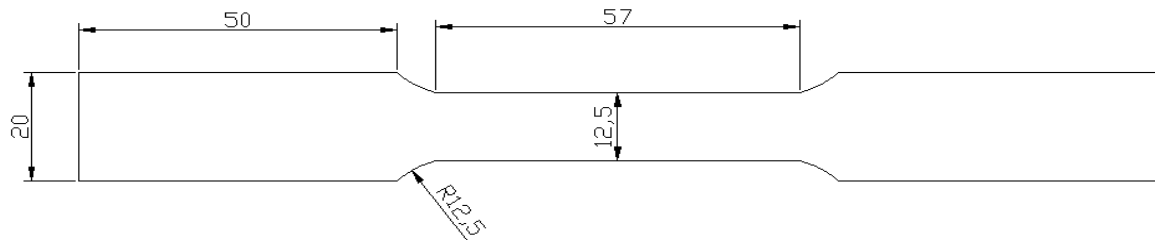


Fig.4.A Tow Dimension of the specimen (Non-weld) (mm)

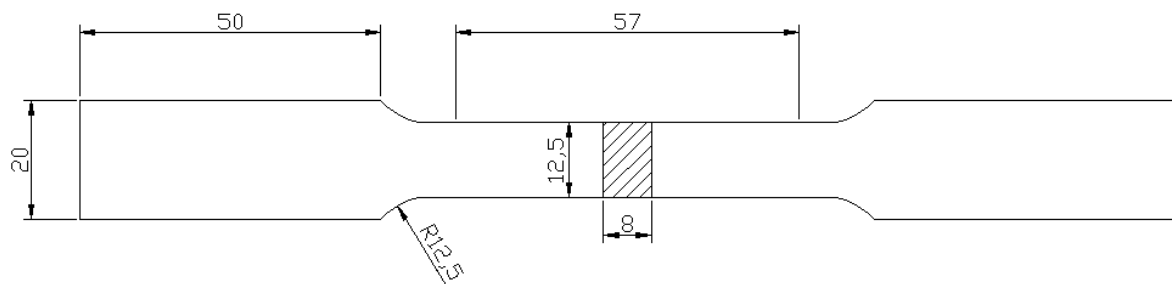


Fig.4.B Tow Dimension of the specimen (Weld) (mm)

2. ANALYSIS OF TENSILE TEST (NON-WELD)

For tensile test in ANSYS, Should go with explicit dynamics analysis. Because tensile test in a non-linear case and using explicit dynamics will give the best results.

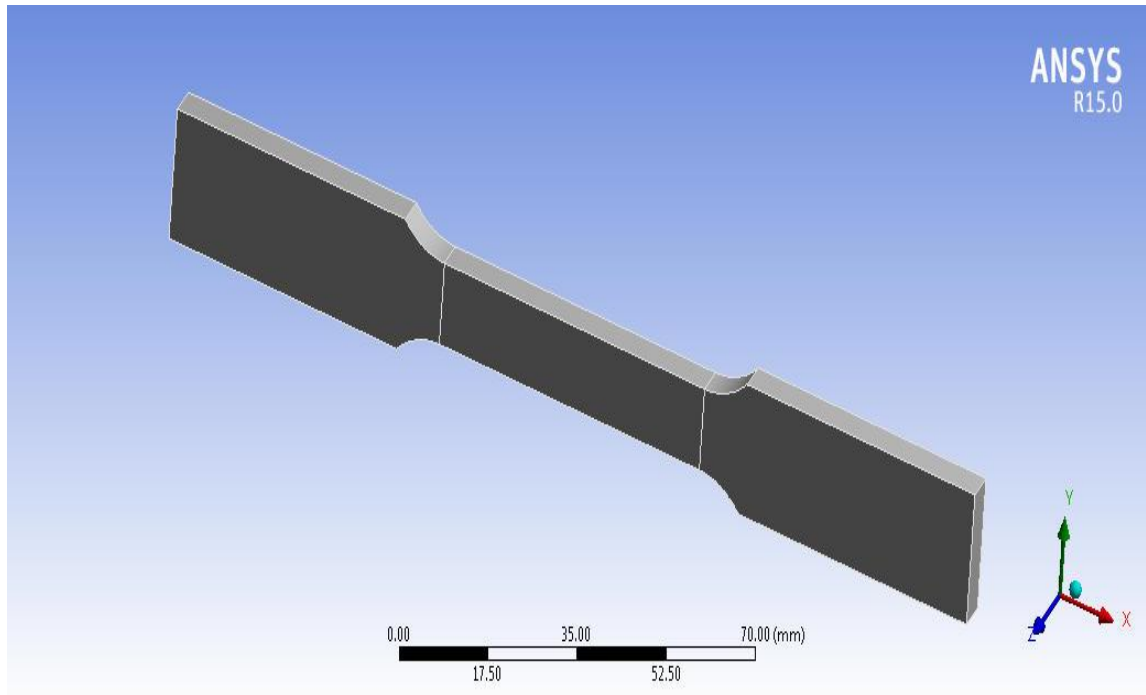


Fig.5 Model of Tensile Test specimen

2.1 MESHING

The meshing is very significant for the Analysis at all the structural object or body. Meshing is the method of discretization of a body into smaller parts for precision of the results and the set of nodes and elements is Known as mesh.

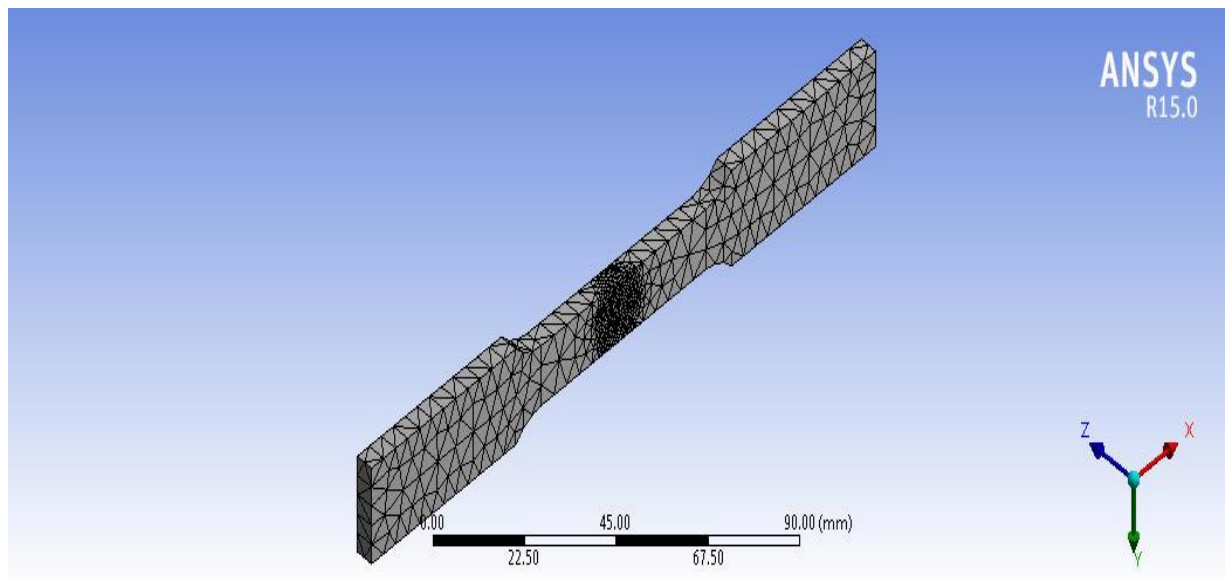


Fig.5 Model of Tensile Test (Non-Weld specimen)

2.2 MARERIAL PROPERTIES

Table 2 : Mechanical properties of working materials

Properties	Value
Density	2.70 g/cc
Tensile Strength, Yield	193 MPa
Modulus of Elasticity	68.9 GPa
Poissons Ratio	0.33
Shear Modulus	26.0 GPa
Specific Heat Capacity	0.895 J/g°C
Thermal Conductivity	218 W/mK

2.3 EXPLICIT DYNAMICS (LOADS & SUPPORTS)

Tensile Test was performed on specimen in ANSYS Workbench out by fixing the specimen from one side by (Fixed Support) and Tensile it from the other side by (Displacement)

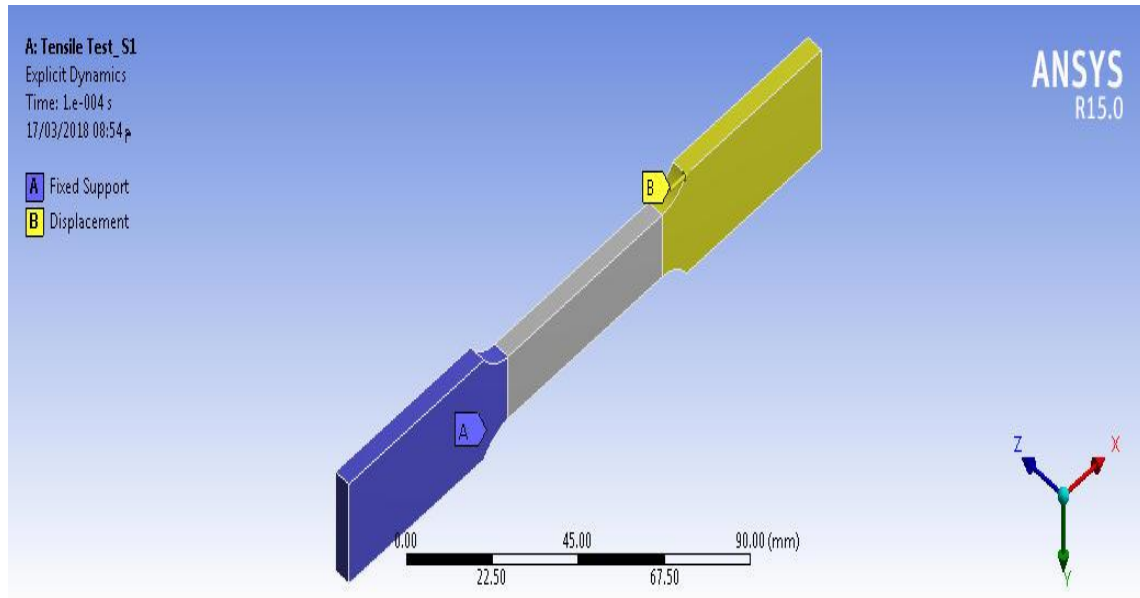


Fig.6 EXPLICIT DYNAMICS (LOADS & SUPPORTS) (Non-Weld specimen)

3. ANALYSIS OF TENSILE TEST (WELD)

3.1 SIMULATION OF FRICTION STIR WELDING

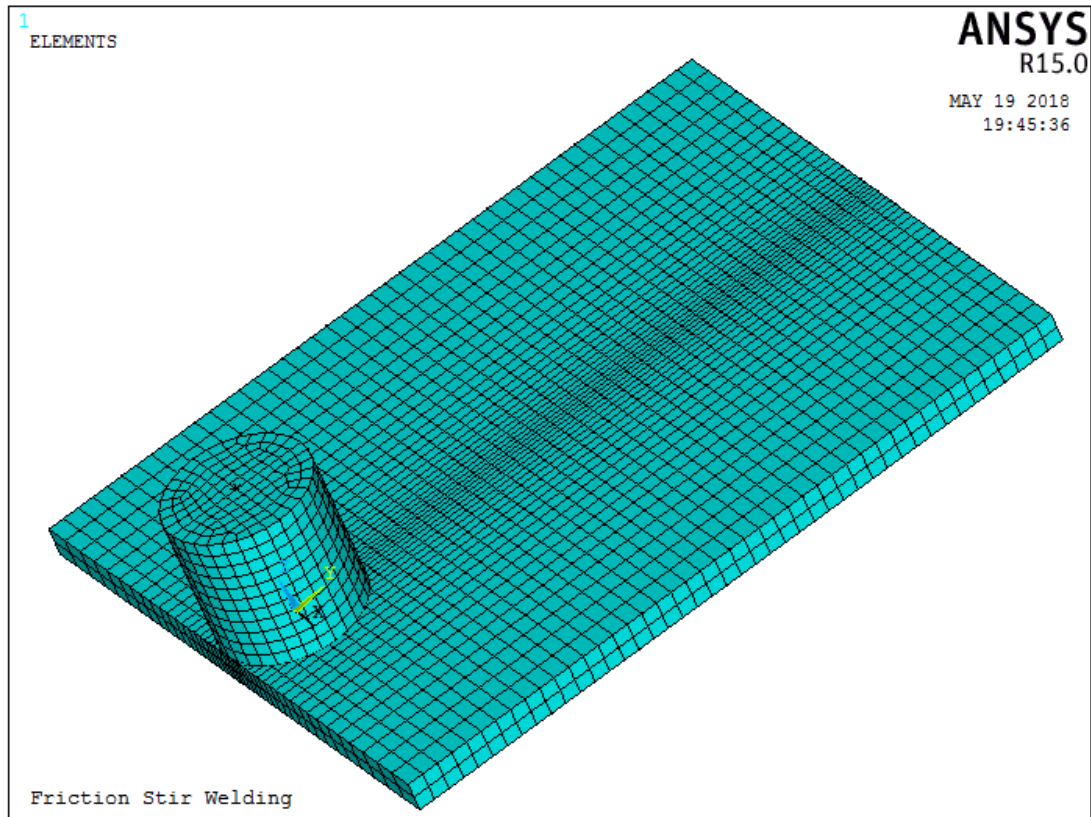


Fig.7 Model of FSW AA6016-T6 in Mechanical APDL

Table 3 : Parameters of FSW

Rotational velocity	1200 R.P.M
Feed	40 mm/Min
Time =distance/speed	200/40 = 5 Min
Load	70 N

3.2 MODEL & MESHING

Cut Material in ANSYS

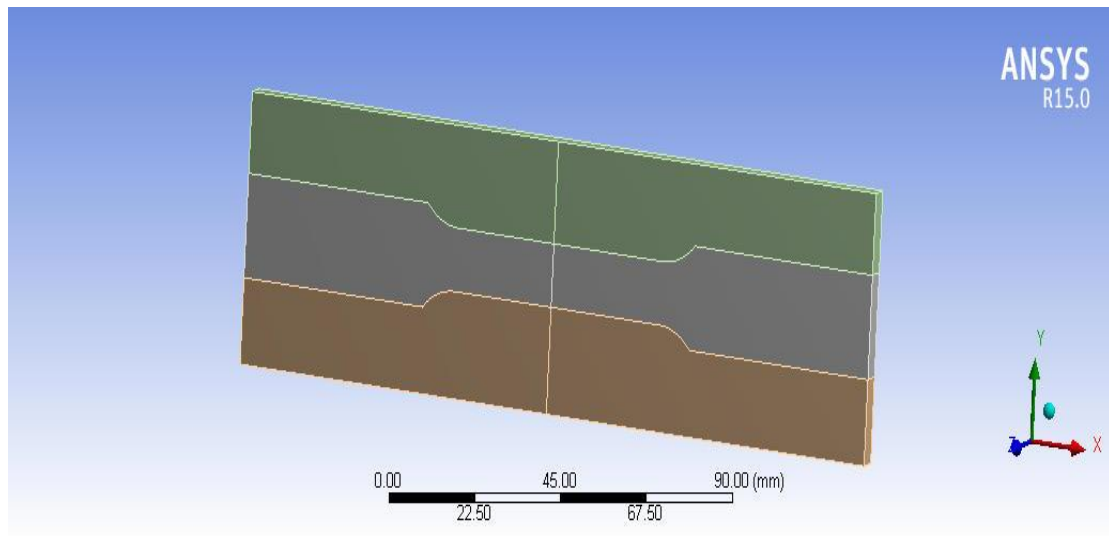


Fig.8 Face split & Cutting Material

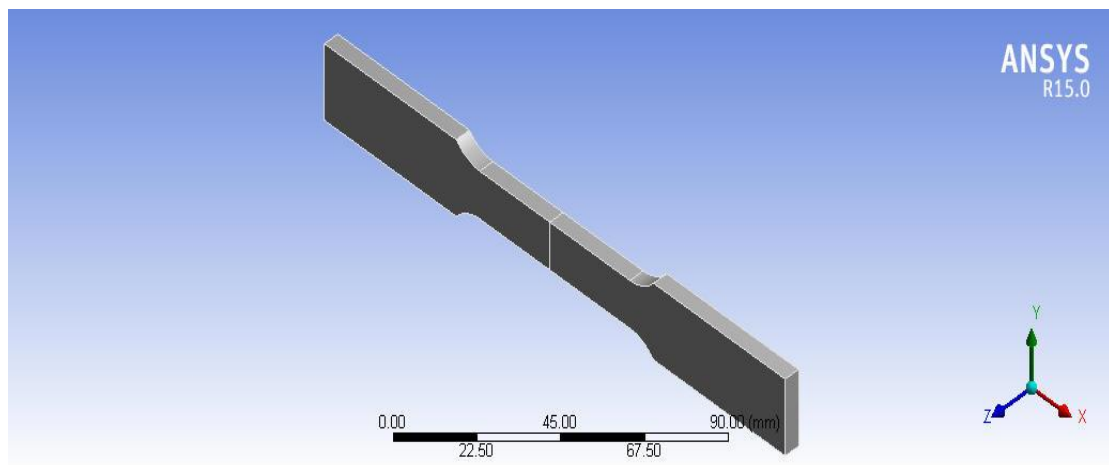


Fig.9 The Model of A welded specimen (Ready for Testing)

3.3 EXPLICIT DYNAMICS (LOADS & SUPPORTS)

[A] Fixed Support

[B] Displacement

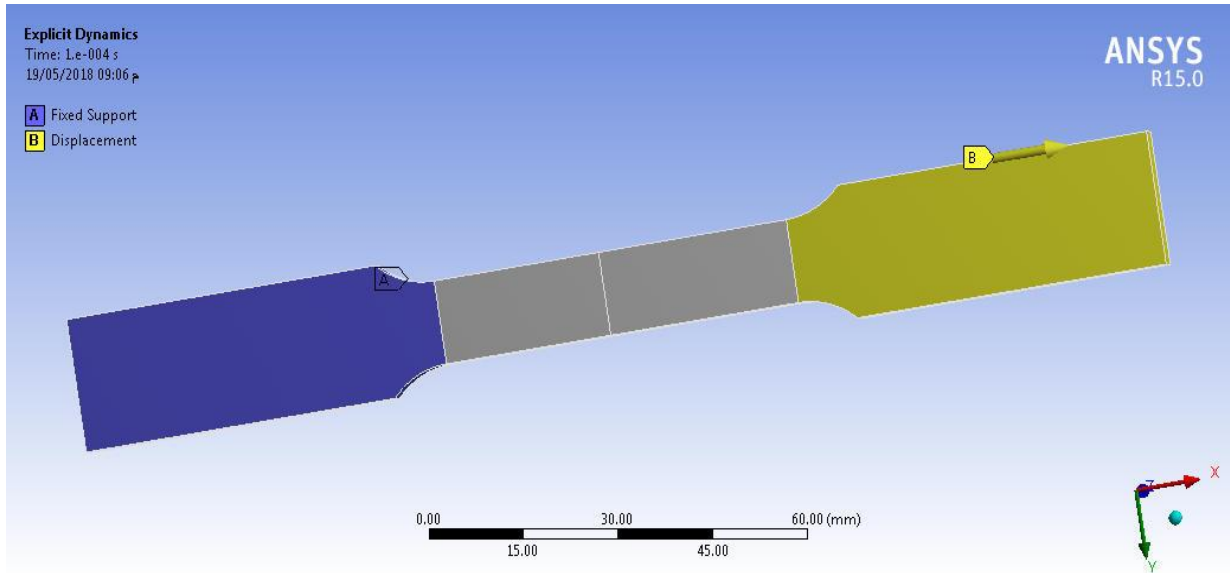


Fig.10 Model of Tensile Test (Weld Specimen)

4. ALL ANALYSIS RESULTS

Table 4: Comparison results between Weld & Non Weld Specimen

	Non-Weld	Weld
Equivalent Stress	419.82 MPa	509.74 MPa
Normal Stress	473. MPa	302.5 MPa
UX	7.4564	5.9865
UY	3.2238 mm	2.4322
UZ	1.7921 mm	1.3644

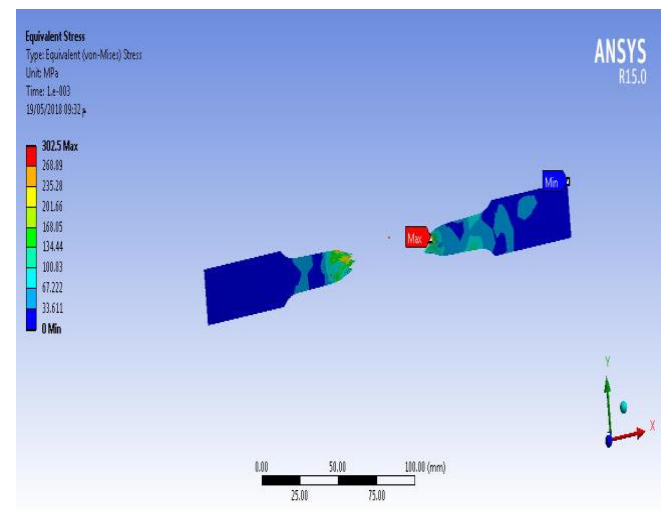
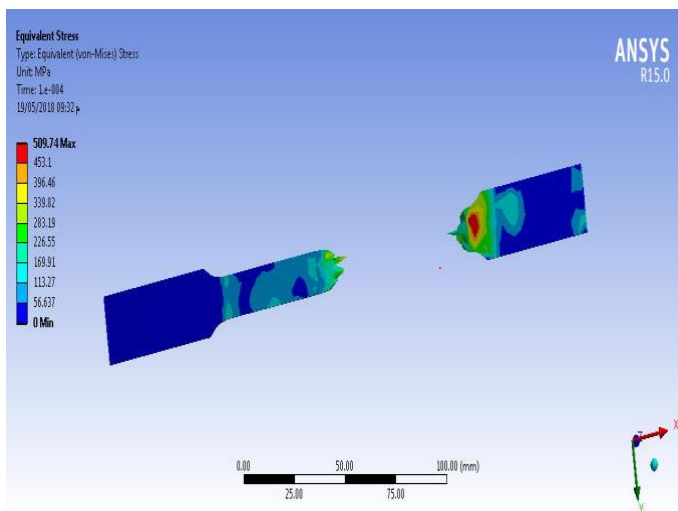
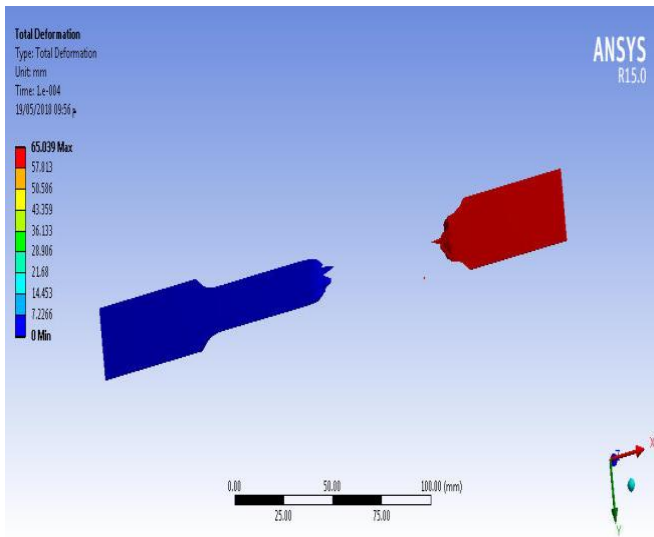
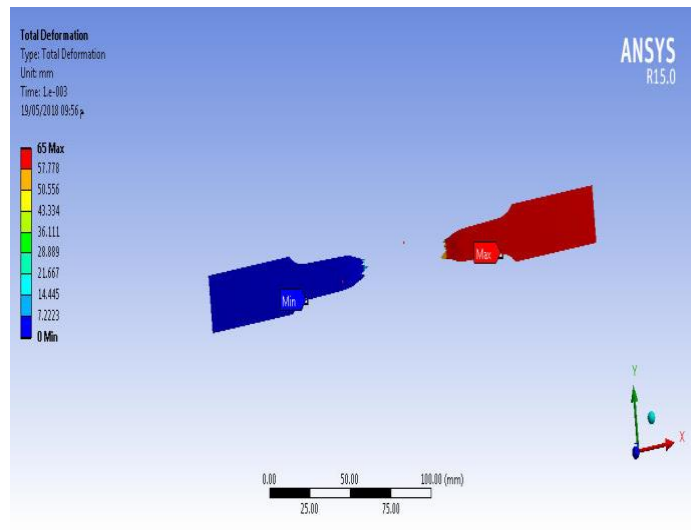


Fig.11 Equivalent Stress A) Weld Specimen B) Non-Weld Specimen

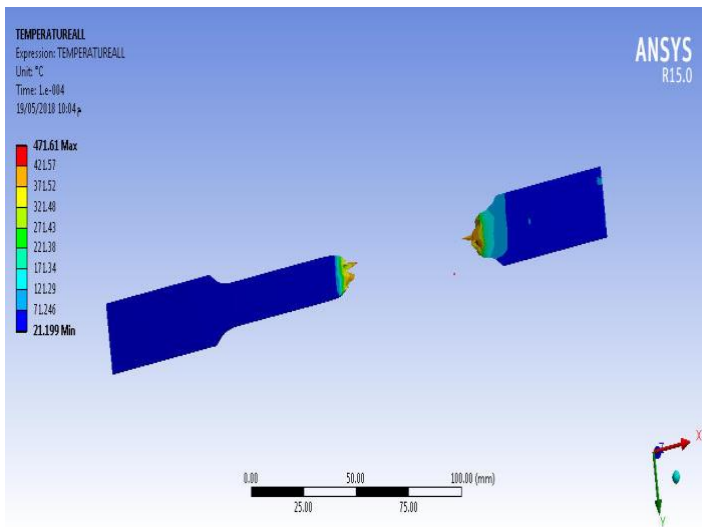


(A)

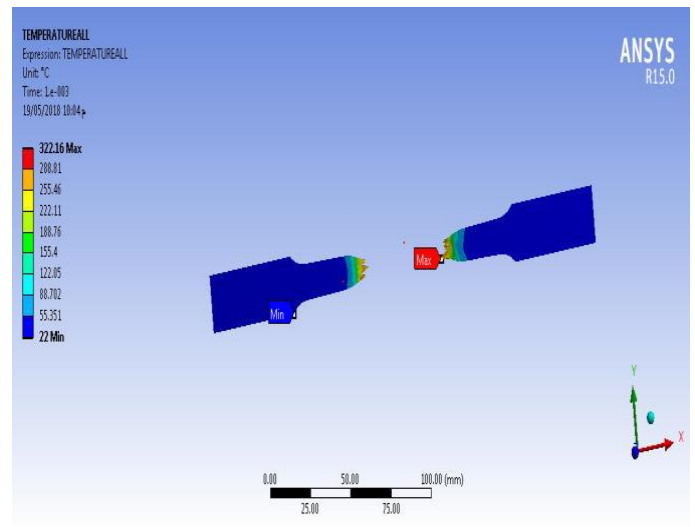


(B)

Fig.12 Deformation A) Weld Specimen B) Non-Weld Specimen



(A)



(B)

Fig.13 Temperatureall A) Weld Specimen B) Non-Weld Specimen

5. CONCLUSION

It was observed that the mechanical properties such as tensile strength and hardness were getting better in the Friction Stir welded and produce low welding distortion. Thus Friction stir welding technology has the potential to play an important role in the near future for improving the quality of the engineering components

6. REFERENCE

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