

Influence on hardness and impact strength of mild steel under the application of electric field

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Abstract: This paper deals with the low carbon steel specifically A36 which is considered the most important structural component of tanks, ships, buildings. Since A36 mostly deals with mechanical systems, structures and processes, so this paper will show the effect of voltage on its mechanical properties. Various mechanical tests have been performed which show that generally all the mechanical properties decrease with the increase in voltage.

Mild steel is the most common industrial material. It the major component of structures like bridges, buildings etc. It is widely used in storage tanks, ship buildings^[1]. The product which has been taken into consideration is A36. This is most used product of low carbon steel with the carbon content ranging from 0.175 to 0.25 % (wt %). Due to high industry demand of A36 it is necessary to study its mechanical properties like ductility, hardness, and fracture toughness. Sometimes A36 is used in welded joints, so the study has been carried under the influence of applied potential difference.

The chemical composition and mechanical properties of A36 low carbon steel is shown in table 1 and 2 below^[2]

Table 1, composition of A36 mild steel

Element	Wt (%)
Carbon	0.25
phosphorous	0.40
sulphur	0.050
copper	0.20
manganese	1.03
silicon	0.280
Iron	98.0

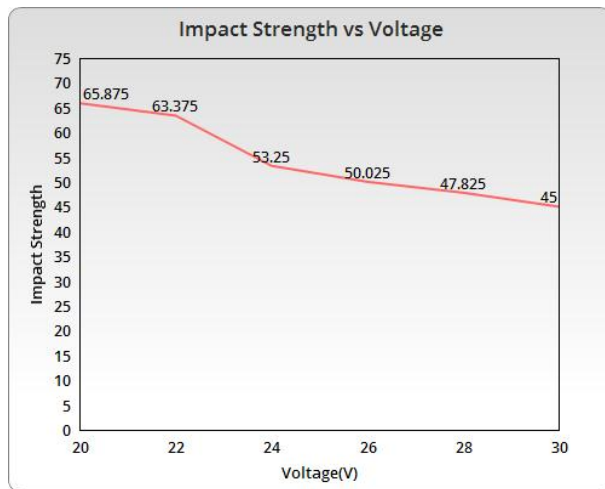
Table 2, Mechanical properties of A36 Mild steel

Mechanical Property	value
yield strength	250 (Mpa)
Ultimate strength	400 (Mpa)
Elongation	24.5 %
Hardness	155 HB

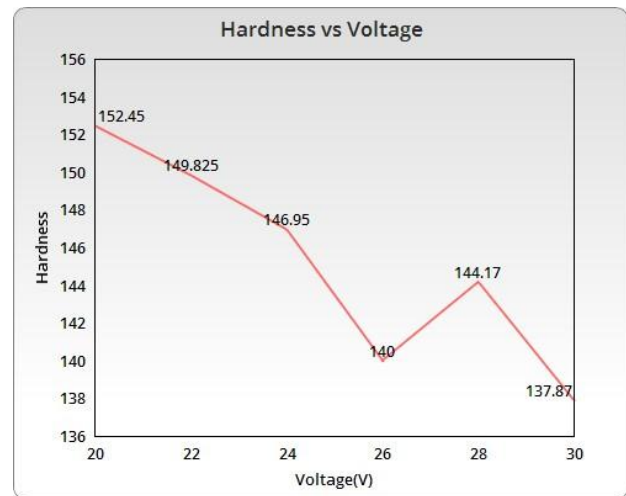
Tensile test is required is required to determine the yield stress and ultimate stress. The specimen specification is given in the table below^[3].

Table 3, specimen specification

Dimension	value
Gauge length	56
Diameter	11.28
Radius of fillet	10
Reduced section	62
Section distance between the shoulders	84.56



(2)



(3)

Figure : (2) Graph between impact strength of A36 Mild steel and voltage and voltage applied (3) Graph between hardness of A36 Steel and voltage applied.

From the above graphs and data the experiment can be summarized in following points:

1. Hardness of the specimen changes 9.56 % when voltage changes from 20 to 30 volts.
2. Impact strength of the specimen changes 31.6 % when voltage changes from 20 to 30 volts.
3. Yield strength changes 12.36 % when voltage changes from 20 to 30 volts.
4. Ultimate tensile strength changes 4.09 % when voltage changes from 20 to 30 volts.

References:

- [1] CHEN, Cheng-Cheng; CHEN, Shyh-Yeang; LIAW, Jiunn-Jye. "Application of low yield strength steel on controlled plastification ductile concentrically braced frames". Canadian Journal of Civil Engineering, 2001, 28.5: 823-836.
- [2] ESAKLUL, Khlefa Alarbe (ed.). Handbook of Case Histories in Failure Analysis, Volume 1. ASM International, 1992.