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COMPARATIVE STUDY OF 12% Cr STEEL AND 8% Cr STEEL

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ABSTRACT

Day by day automobile industry demanding more crash performance, more fuel efficiency, more safety, etc with less weight. To achieve it day by day new materials comes into the picture with high strength sheets. Even space shuttles also working on same by which they can be more economic, more efficient etc. Tool and Dies wear phenomenon is totally different in this type of blanking phenomenon. Lot of automobile parts are made from high tensile sheets where their tensile strength is more than 1000N/mm2. There is a tendency if we put more we get more. Which is not correct? We will compare D2 (Din 1.2379) with 8 % Chromium Steel for tooling. One more very interesting thing found during survey that generally in tooling same type of steel family used E.g. for Cold work → Cold work steel like D2, O1, S1, etc for Hot Work→ Hot Die Steel like H11, H13 etc.

KEYWORDS— Steel, Chromium

I. INTRODUCTION

As discussed earlier due to increase fuel efficiency, environmental and safety concerns, automotive companies are using high-strength light weight alloys and advanced/ultrahigh-strength steels in body panels and structures of the car. Due to less weight without compromising safety and durability, fuel consumption and hazardous emissions got decrease. But during stamping and blanking process Tool and Die wear increases, Pre-mature failures increases during production. These failures are due to higher forming forces, higher surface hardness, etc. These failures increase unexpected production cost very high. These premature failures can be avoided by using proper steel for tool and die which can sustain load, which can resist against propagation of cracks or we can say directly which is having higher toughness with same strength. Different coatings on the tool also very helpful up to certain extent, different lubricants also reduce friction loads.

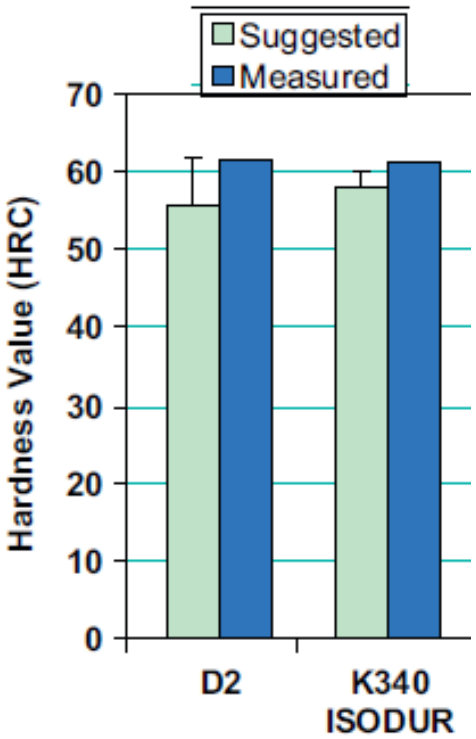
Proper combination of Good Tool Design, better tool steel, good coating better lubricant can give die life in multiples.

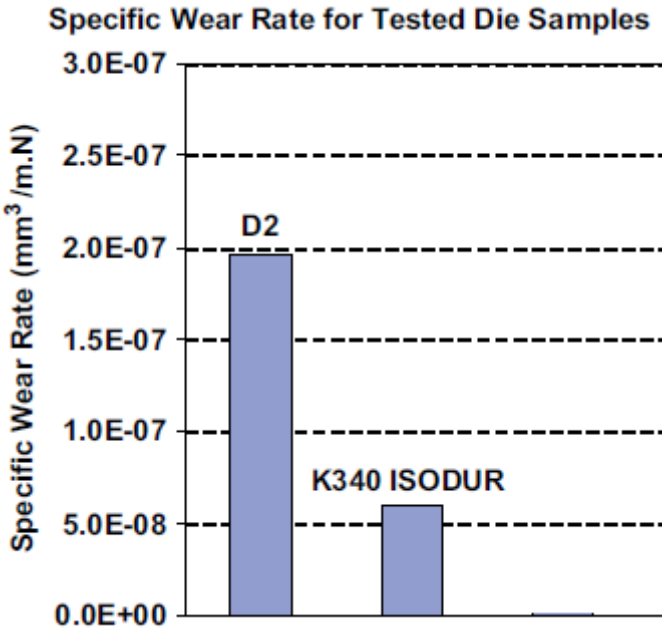
DATA COLLECTION AND EXPERIMENTATION

A tool Steel material denominated as 1.2379 and 8 % Cr Steel was investigated. The chemical composition is given in table 1. We select K340 as 8 % Cr steel.

	Fe	C	Cr	Mo	V	Si	Mn	Al	Nb	N	Density (Kg/m3)	Young Modulus (Gpa)	Compressive Yield Strength Rc0.2(MPa)
K340	bal.	1.04	7.95	2.12	0.41	1.08	0.22	1.04	0.04	0.013	7615	210	2200
D2	bal.	1.55	11.8	0.8	0.8	0.3	0.4				7700	210	2250

Standard Charpy V specimens are prepared by high speed machining.
Do standard Charpy V impact testing and check toughness of different sample after hardening and tempering.





Specific Wear Rate == Wear Volume / Applied Load.

Grade	Specific Wear Rate(mm3/N)
D2	19.62 X 10-8
K340	6.254 X 10-8

One amazing thing we found that at same hardness we got different toughness. Lower Hardening temperature gives more toughness and number of tempering cycles also improves toughness. But we also found wear strength is also varies inversely as toughness changes. But after 4th tempering toughness increment is minimum 8 % Cr steel shows lower specific wear rate in comparison to 1.2379.
8% Cr steel shows far better toughness and in the practical sheet metal dies got improved version of die life. This life increment we found where failure mode is crack/chip-off. But where failure mode is wear their 8 % Cr steel not gives better results.

PROPOSED FUTURE WORK

Different type of steels can be use and by modification in chemistry we can produce better tool steel with lower alloying elements. So win-win situation for steel manufacture as adding alloying elements is a cost and better tool life can increase the benefits of tool user.

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