Cautionary Tales Part XVI

Spring Materials – and their specification

The last few cautionary tales have been about aspects of technology and their use in the spring industry, but this one is about spring materials, although mention is made of induction heating, a technology that is becoming more important to some parts of the spring industry. An earlier Cautionary Tale, no. XI, discussed spring materials and asserted that the materials used throughout the world are very similar. This assertion provoked a response from one reader that newly developed materials are sometimes the subject of exclusive use agreements between supplier and springmaker for some period of time. Notwithstanding, *IST* are confident that virtually all spring materials are available worldwide, and that there are only small differences in material usage from country to country.

However, there are a number of aspects of spring materials that are not (adequately) described in standards. For instance, dry drawn carbon steel and stainless steel will have a residual lubricant coating – coatings which have a considerable influence on a springmaker's ability to make consistent high quality springs. The thickness and chemical constitution is not specified in international spring material standards, but it is not clear that more stringent specification of this aspect of wire supply would enhance quality in the spring industry. Other aspects of spring wire that are not fully described include

- The type of phosphating – Fe, Zn or Mn
- The process by which a pearlitic structure is produced – air or lead patenting, illustrated in figures 1 and 2 – the air patented structure has more free ferrite, but is still of good commercial quality.

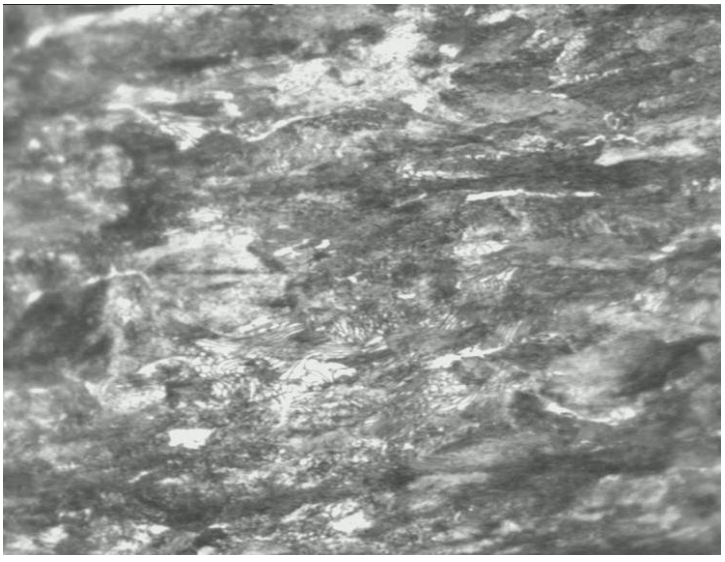

Figure 1 Air patented 0.22" wire x880

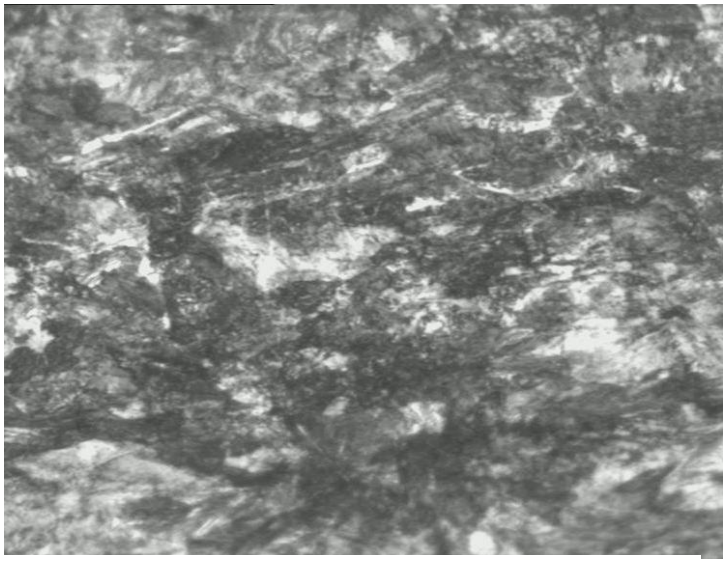

Figure 2 Lead patented 0.22" wire x880

- The oxide coating on oil tempered wires
- The elastic limit or 0.2% proof stress of drawn carbon or stainless steel.

In a similar way, the means used to heat wire for hardening is not specified in standards, and there is no need for the standards to be specific. The objective of a harden and temper heat treatment is to obtain a structure of tempered martensite, as described in Cautionary Tale VI. If the heating to austenitising temperature is carried out by conventional heating, then it will take minutes (one minute for small diameter wires for oil harden and temper, and 30 minutes or so for large diameter bars for hot coiling) to attain the required structure and temperature. There is an alternative means of heating and that is by induction, a method that will enable the required structure and temperature to be achieved in seconds.

Induction heating is becoming more widely used, both for the production of oil tempered wire, and for heating prior to hot coiling. The increased process throughput is not the only reason for preferring induction methods - the material is at austenitising temperature for much less long and so will not be prone to decarburisation, oxidation or grain growth. If it is tempered immediately also by induction methods, as will be the case for hardening and tempering wire, then it can be water quenched without risk of cracking. The net result of more rapid heating and quenching is that spring wire grades such as SiCr can be produced with a higher tensile strength than conventionally heated products and still the level of ductility is sufficient to enable cold coiling.

The moral of this cautionary tale is that there are aspects of spring material quality that are inadequately described in international standards, but there is not yet a clear case for increasing the level of specification. Every aspect specified will have to be tested, and this will push manufacturing costs up, and one can only justify such action when there is a clear economic case for the whole industry. Nonetheless, you should be aware of the inadequacy of the specification of some parameters, and for the success of your business you may need to specify your purchases more fully to receive spring material of the quality you require. In addition, if your supplier were to change one of these unspecified aspects, they ought to keep you informed, and you might have to inform your customer of the change in order to comply with the requirements of QS 9000.

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