TUBULAR TIRES: ADHESIVES AND PRACTICE
PART 5

Curing Time

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Tubular tire-rim combinations offer performance advantages over their clincher tire-rim counter-parts. Their lighter weight leads to better jump (acceleration) and lower overall weight. Despite these advantages, riders are reluctant to use tubulars because of the perceived difficulty in mounting, repairing and safety. While clinchers are increasingly popular in racing situations because of these perceptions, working with tubulars will continue to be part of the mechanic's responsibilities.

This is the fifth in a series of articles intended to dispel the difficulties in mounting, use and repair of tubular tires and to improve reliability to minimize the potential for roll-off -- the failure of the adhesive bond between the tire and the rim. In the first four parts (with C. Calvin Jones, Cycling USA, 1995. XVII(8) - XVII(11)), recommendations for adhesive application and tubular mounting are given. Bond strength using various combinations of types of rims, tires and adhesives are discussed. The 'white' glues, Continental and Vittoria Mastik'One, are superior to the 'red' glues. Adhesion to carbon fiber rims is markedly less than the adhesion to aluminum anodized rims. The application procedure developed by Calvin Jones and tested in my laboratory proved superior to the respective manufacturers' recommended procedures.

The most significant perceived disadvantage to tubular tires is the potential for the tire to roll-off the rim. The resistance to roll-off is a combination of the rim shape, tire stretch, air pressure and adhesive use. The mechanic has control over the adhesive use. Over 60% of the resistance to roll-off is due to the adhesive bond. If this fails under lateral load such as corners and pedal-catch, the tire will roll-off the rim causing a loss of traction, stability and potential rider injury. While all adhesives will fail given sufficiently extreme conditions, their proper use will raise the limits before roll-off.

This article presents recommendations for curing times before use of a freshly glued tire. All of the measurements supporting these recommendations were done under controlled laboratory conditions. These conditions will not always represent those in the field. Therefore, mechanics should temper the conclusions drawn

here with their experience. The safety of the rider is paramount. The combination of these recommendations and mechanics' experiences should lead to a safe mounting of tubulars.

Curing Time

When a tire needs to be installed and ridden immediately, clinchers should be used. Tubular tire adhesives require time to cure to allow the bond to come to full strength. In the recommended mounting procedure, the final of the three coats of adhesive is applied to the rim, the tire is mounted, it is fully inflated and the adhesive is allowed to cure for at least 24 hours before riding. While some adhesive bonds come to full strength in less time, this recommendation -- based on experience with many rim - tire - adhesive combinations applied under many conditions -- should allow all tubular tire adhesives to reach maximum strength.

For this article, Mavic anodized rims, Ultech Nomad tires and seven different adhesives form the experimental basis. Mavic hard anodized rims and other tires have performance consistent with these. Adhesive bond strength is reported relative to Vittoria Mastik'One which gives superior strength after 24 hours of curing. It is assigned a relative strength of 1.00. The relative strengths of all adhesives tested after a cure time of 24 hours are:

Vittoria Mastik'One	1.00
Continental	0.90
Clement	0.83
Vittoria Gutta	0.84
3M Fast Tack	0.73
Pana Cement	0.58
Wolber	0.59

A second series of experiments was then run where new multiple tire sections were glued to clean rim sections using a specific adhesive. Bond strength was tested at regular intervals (1 hour, 2 hours, 6 hours, 1 day, 2 days, 4 days and 7 days) after installation. In the figure below, the relative strength compared to the strength of Vittoria Mastik'One at 24 hours of cure is reported as a function of time from installation. Mastik'One and Continental continued to strengthen, so their relative strengths at the end of the study exceed 1.00. The figure shows that most of the adhesives achieved their full strength after 24 hours. Clement's performance, among all of the

adhesives, was the most variable. In this study, it never achieved the strength measured in the first set of experiments.

One of the results of this series of measurements was the determination of which adhesives cure quickest under laboratory conditions. One hour after installation, Mastik'One and Continental were the fastest to cure. They both had achieved nearly 80% of their final strength after 1 hour. These two were the best performers. One notable example with a slower cure time is 3M Fast Tack. This is an auto trim adhesive. If is not designed for tubular installations but nevertheless widely used. It has the reputation among many mechanics for a fast cure time. In reality, its strength after one hour was only 55% of its final strength and only 50% of Mastik'One's one hour strength. It is essentially equivalent to the performance of Wolber. This should dispel the reputation for fast cure times.

Curing time is a function of temperature conditions. While warmer temperatures will speed curing, extremely hot temperatures will result in adhesive failure. Cold temperatures will require longer curing times. In extremely cold conditions, the adhesive will not cure.

Conclusions

Cure time is important to allow adhesives to reach their maximum strength. The strength directly after installation is substantially below that after a 24 hour cure time. The two white glues designed for tubular applications (Vittoria Mastik'One and Continental) had the fastest cure times and the greatest strength after 24 hours. The trends shown above form the basis for the recommendation that a cure time of 24 hours before riding should be the goal. Naturally, riders will flat requiring installation on the road. In that situation, a one day cure is not possible. The glues with the fastest cure time should then be the ones of choice.

Each of the above adhesives have been used under extreme conditions without the tire rolling off the rim. Therefore, this information should not be interpreted as recommendation against any of the above adhesives. The measurements do show that some adhesives perform better than others but the bond strength may be far above any requirements experienced on the road.

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Citations

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