

Comment on “Photoemission Study of $\text{YBa}_2\text{Cu}_3\text{O}_y$ Thin Films under Light Illumination”

In Ref. [1] Asakura *et al.* suggest that the doping level in $\text{YBa}_2\text{Cu}_3\text{O}_y$ (YBCO) films grown on Nb-doped SrTiO_3 (STO:Nb) substrates is modified due to injection of photoelectrons from the STO:Nb substrate into the YBCO film. However, it is well established that YBCO on its own has intrinsically very pronounced effects due to photoinduced doping changes [2]. The presence of these *intrinsic* photo-doping effects puts into question the role of any photoelectrons from the STO:Nb substrate for the experiments of Asakura *et al.* Theoretically this implies that the origin of the effect does not reside in the photoelectrons generated in the STO:Nb and the same effect will be observed independently of the choice of substrate.

Intrinsic photodoping effects of YBCO have been thoroughly studied in the past. Upon illumination with visible or uv light YBCO shows both transient [3] and persistent [4] photoconductivity. Furthermore, the photoexcitation in YBCO is most pronounced in the uv part of the spectrum [5], which Asakura *et al.* use for their photoexcitation. The photoinduced effects are intrinsic to YBCO, since photoinduced doping changes are observed in single crystals [3] as well as thin films on substrates of either MgO [6,7] or STO [4,5]. This is in marked contrast to photocarrier injection in VO_2/TiO_2 :Nb heterostructures [8], where the choice of substrate clearly determines the photoinduced effects. Quite the opposite is true in the case of YBCO/STO:Nb since photoinduced resistance changes for YBCO films on STO:Nb, similar to the ones investigated in Ref. [1], are essentially identical to photoinduced changes for YBCO films on MgO; i.e., compare Fig. 2 in Ref. [9] and Fig. 2 in Ref. [10].

It should be noted that similar *intrinsic* photoinduced doping changes have also been observed in many other perovskite materials, such as other high- T_c superconductors [11] and colossal magnetoresistive manganites [12]. Thus, even without any specifically designed heterojunctions, photodoping is indeed a powerful technique for studying doping dependent physical properties in these complex correlated electron systems.

The surface cleaning procedure reported in Ref. [1], where the sample is heated in vacuum, is likely to deoxygenate the YBCO film [13], enhancing the photoinduced phenomena [14]. Therefore, an explanation solely in terms of photogenerated carriers injected from the STO:Nb substrate into the YBCO film at the interface of the heterojunction cannot be put forward without checking the relative importance of the well-known intrinsically photogenerated carriers in the YBCO. Whether the injection of photocarriers from the STO:Nb substrate plays any role could easily be assessed by using a YBCO film grown on a different substrate as a control. To our knowledge, no such control experiment has been reported for YBCO films in

either Ref. [1] or previous publications by the authors. Furthermore, note that the observed core-level spectra shift of 0.78 eV is consistent with shifts observed due to chemical doping of YBCO [15].

To summarize, the authors of Ref. [1] derive conclusions without considering previous, well-established results on *intrinsic* photoinduced effects in high T_c superconductors and other perovskite thin films, or performing control experiments to discard its existence in the data. Thus the interpretation of the results in terms of injection of photoelectrons across a heterojunction is questionable.

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