to analyze the failure behavior of the specimen. At the beginning of the experiment (4.8KN), the deformation of the whole specimen was very small and uniform. Then, strain field shown a clear stratification with the loading increase. The deformation at top and bottom was small than that at middle of the specimen. When the load reached the compressive load (18.6KN), the strain concentration became significant. The strain concentration band appears at the center of the specimen first and then grows along the middle line to the left and right side with the loading increase, finally run through the whole specimen and caused the failure. Furthermore, the position of the real crack shown in Fig.7 is also similar with the strain concentration band so that using the strain field calculated by DIC is proved to be efficient in the failure behavior analyzing.

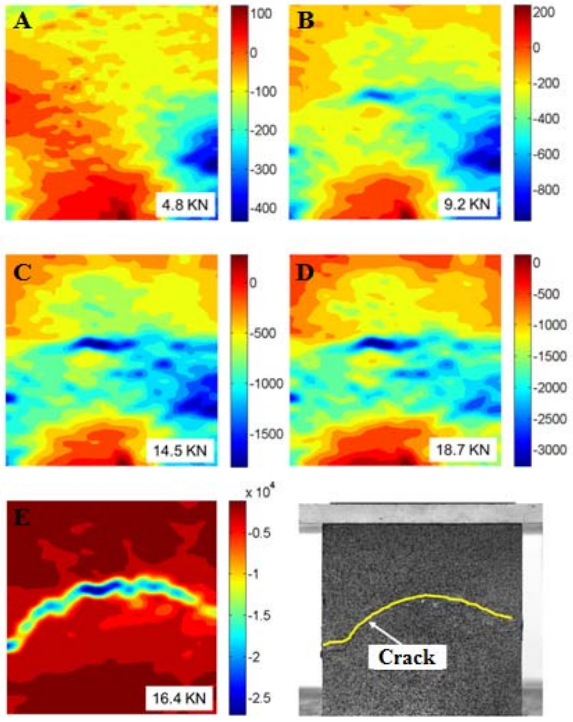

Figure7. the strain fields in *y* direction under different loading levels

In addition, the micro-observation research shows that the PAC material is a kind of multi-phase composite material. The cement, perlite, crystals in cement block and unhydrated cement particles are mixed together formed the elastic skeleton when deformation happens. But the pores and micro cracks inner the material are considered to be the origin of the damage. From the loading curve, deformation field and the images of the specimen, it can be found that the deformation and failure behavior could be divided into three stages: in stage I, the stress grow from zero to 40%~50% limit compressive strength, the stress concentration born at one point in the material. When the tensile stress at this point exceeds the bonding strength of cement gelatinous and expanded perlite, the micro cracks appear. The crack opening will cause the decrease of stress but the accumulation of residual deformation makes the micro cracks growth and extension; in stage II, the stress reach the ultimate compressive strength, the specimen begin to failure and the crack start unstable expansion; in stage III, the number of cracks increases rapidly and begin expanding and connecting, macroscopic crack appear and the specimen destroy finally.

The phenomenon above shows that the deformation and failure behavior of the PAC material is different to the brittle material like rock and concrete. The damage will not happen immediately when the stress exceed the ultimate compressive strength but hinder the rapid expansion of the crack and materials failure by the material large self- deformation. So the material could absorb much energy in damage, decelerate destruction process and be used as light building materials, fire resisting material, thermal insulation material and acoustic material.

IV. CONCLUSION

The mechanical properties of PAC material are measured using DIC method in this paper and the deformation and failure mechanism of the material are deeply analyzed and researched through strain field. The experiment results show that the elastic modulus and Poisson's ratio could be exactly measured by DIC method. Meanwhile, the strain fields show the non-uniformity characteristics of deformation and failure modes caused by the sandwich layered structure of the material. The experiment method provided in this paper gives another choice when measuring the PAC material and the experiment results also have some reference value for material design and safety applications.

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